SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1891, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIV.—No. 21. ESTABLISHED 1845. NEW YORK, MAY 23, 1891. $3.00 A YEAR. WEEKLY.

THE PROPOSED HUDSON RIVER SUSPENSION BRIDGE.

Nearly a year has elapsed since we illustrated the proposed bridge across the Hudson River, to be constructed from designs by Mr. Gustav Lindenthal, of Pittsburg, Pa. At that period the bill authorizing the construction of the bridge had passed the House of Representatives, and was awaiting action by the Senate. The bill has now passed both Houses, has been signed by the President, and is law. Under it the question of the height is left to the discretion of the Secretary of War, provided a minimum height equal to that of the East River bridge be obtained. This question was delegated by the Secretary of War to the Board of Army Engineers, sitting in New York City, and plans have been just approved by the Secretary of War and the height fixed at 150 feet above high water.

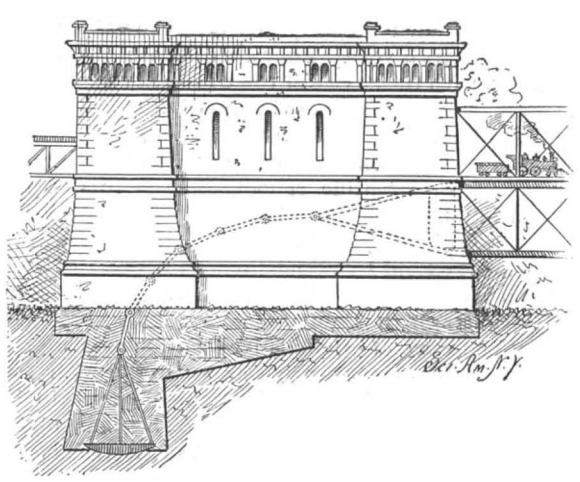
The plan of the bridge has been modified in several respects, and we give a perspective view of the proposed structure. It will comprise five divisions: a central span, two land spans, and two approaches. The bridge proper will start from the New Jersey anchorage, abutting on the northwest corner of Bloomfield and Twelfth Streets, Hoboken, and on the New York side will terminate at its anchorage on the northeast corner of Twenty-third Street and Tenth Avenue. The distance between these points, as far as ascertained, is 6,650 feet. The central span will be 3,100 feet from center to center of piers, and the shore spans will be 1,750 feet each, measured as above. The clear span of the central bay is to be 2,920 feet.

At the point selected for the bridge there is a space of 2,740 feet between the pier head lines as established by law. Both piers come inside of this line, so that the legal channel of the river is not to be interfered with.

The structure is to be of steel for the roadway and towers, while stone and concrete (beton) will be used in the anchorage and foundations. These foundations it is proposed to establish upon the solid rock.

Double steel towers 525 feet high, on foundations 180 by 350 feet, will carry the cables, which will pass over balancing saddles. The cables, four in number, are to be arranged in pairs, one nearly vertically over the other, and of 48 to 50 inches diameter each. The cables are 55 feet apart vertically. To prevent deformation and to cause the cables to act to a certain extent as truss chords, diagonal braces are inserted between the members of each pair of cables. The whole thus constitutes two arched trusses, which will resist deformation from strains to considerable extent.

The cables are to be made of steel wire, laid parallel,



DOUBLE CABLE ANCHORAGE AND ANCHORAGE PLATES.

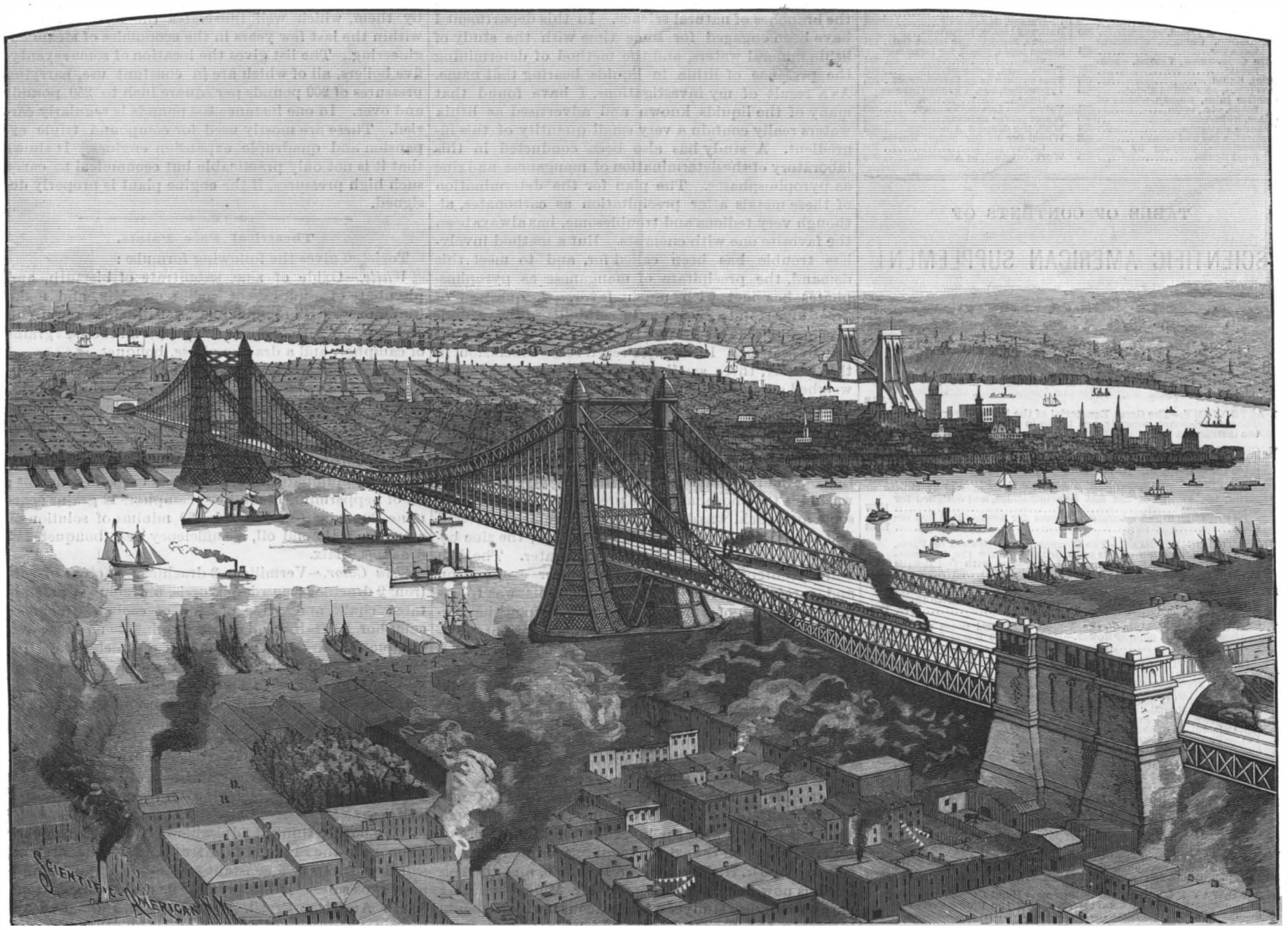
and bound together at intervals; but they are not to be bound with wire, as in the East River bridge, but are to be surrounded by a cylindrical sheet steel casing bolted on. This casing is to be water tight, and of such size as to provide two inches of space all around the cable for the circulation of air and for the equalizing of temperature. It has been found that in this gigantic structure uneven heating of the wire cable would produce undesirable strain, and the covering of the cables will to some extent counteract this. The planes of the cable are inclined about eight per cent from the vertical, in order to give stiffness to the structure.

With extreme ranges of temperature, it is calculated that the center of the cables will rise and fall through a range of nine feet. Thus in cold weather the height of the bridge at its center may exceed by 4½ feet its normal height.

Two anchor columns are placed at intermediate points between the anchorage pedestals and the main towers. These are entirely below the roadway and carry no dead weight, but come into action in cases of unequal loading.

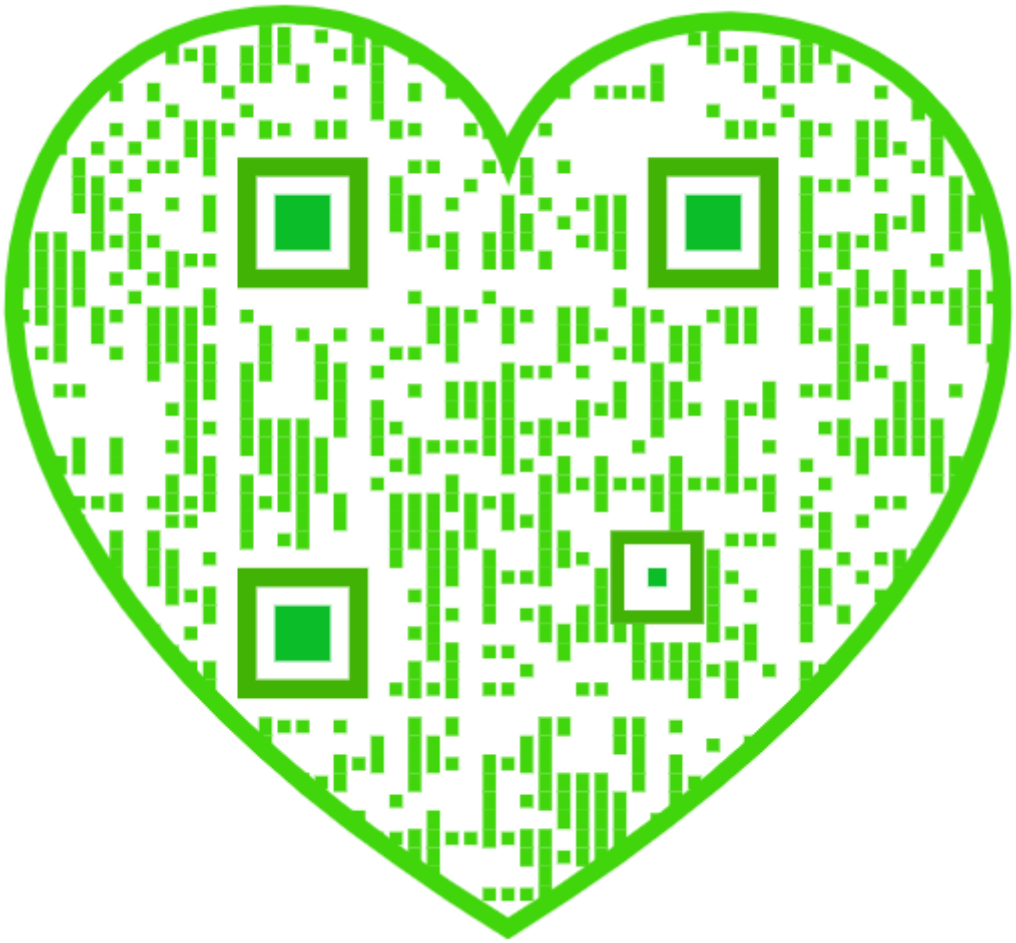
The maximum load to be allowed is only equal to one-quarter the ultimate strength. As live loads in the calculations, for each of the main tracks a 1,000 foot 1,200 ton train was assumed, and for the rapid transit tracks a 300 foot 200 ton train each, while for the promenade 13,000 men were assumed. All this weight was supposed to be placed upon a single span, with the result of indicating the large factor of safety expressed above. With 1,330 locomotives loading the bridge from end to end, only one-third its ultimate strength will be called upon. The dead weight of the structure will be nearly three and one-half times this amount. The suspended framework is to be made as rigid as possible.

(*Continued on page* 323.)



THE PROPOSED HUDSON RIVER SUSPENSION BRIDGE, CONNECTING NEW YORK AND HOBOKEN.

© 1891 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement.

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, MAY 23, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

Armor trial, new..... 324
Blackboard covering, Bergmann's..... 325
Bridge, proposed Hudson River suspension*..... 319
Car coupler, Marshall's*..... 322
Cement which resists acids..... 322
Colored population, increase of.. 329
Drill, Watt's pocket forming*.... 322
Egyptian remains, recent discoveries of..... 325
Electric dynamos, the care of.... 328
Elements, genesis of the..... 329
Engineering, steam, progress.... 320
Exhibition, Chicago, classifications for..... 321
Fire department, Vienna, apparatus*..... 327
Fuel, liquid..... 323
Gas pipes, something about..... 323
Gastric juice, human, effects of foods, etc., upon..... 321
Glass, iridescent*..... 329
Granite statistics..... 324
Helmet, a gas and smoke..... 322
Illustrations, copying by artificial light..... 325
Invention, a needed..... 325
Inventions recently patented.... 330
Letters, illicit opening of..... 325
Locomotive spark arrester, Haddock's*..... 322
Lumbering in California..... 329
Motion, perpetual, machines..... 328
Notes and queries..... 330
Ore washer, Miller's*..... 326
Paints, face, theatrical..... 320
Patents, granted, weekly record of..... 331
Pharmacy, dangers of..... 321
Railroad trains, luxurious..... 328
Spoons, historic, the latest fad.. 324
Steam pipes, small, for large service..... 324
Trade mark, value of..... 321
Tree culture as an investment.... 325
Typewriter, the, a French invention*..... 328
Valve, the Lunkenheimer*..... 322
Water power lighting..... 323
Well, the deepest American..... 323
Wheel for lifting water, Morris Canal*..... 326
Work, original, in America..... 320

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 803.

For the Week Ending May 23, 1891.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—The Great Equatorial of the Paris Observatory.—The new telescope recently put in use in Paris.—Description of the instrument and of its effects.—3 illustrations..... 12823

II. CHEMISTRY.—An Apparatus for Heating Substances in Glass Tubes under Pressure.—By H. PEMBERTON, Jr.—A simple apparatus for effecting this purpose, avoiding risk of personal injury.—2 illustrations..... 12838
Table of Atomic Weights.—A revised table of atomic weights, giving the results of the last determinations, and designed for every-day use..... 12837
Testing Cement.—A laboratory process for testing Portland cement..... 12838

III. CIVIL ENGINEERING.—The Compressed Air System of Paris.—An elaborate review of this great installation for the transmission of power.—The new compressed air station, with full details of performances of apparatus, etc.—10 illustrations..... 12830

IV. ENTOMOLOGY.—Report on Insects.—Continuation of this report on noxious insects.—Their habits and how to cope with them.—18 illustrations..... 12824

V. FLORICULTURE.—Lily of the Valley.—Practical notes on the cultivation of this popular flower.—How to raise it and force the growth..... 12823

VI. MATHEMATICS.—The Conic Sections.—By Prof. C. W. MACCORD.—Examination of the four conic sections with a general definition applicable to all.—6 illustrations..... 12836

VII. MECHANICAL ENGINEERING.—The Builders of the Steam Engine—The Founders of Modern Industries and Nations.—By Dr. R. H. THURSTON.—Prof. Thurston's address before the Centennial Celebration of the American Patent System at Washington, D. C.—The early history of the steam engine and its present position in the world..... 12833

VIII. MISCELLANEOUS.—The Breeds of Dogs.—Popular description of the different breeds of dogs most affected by amateurs.—6 illustrations..... 12826

IX. NAVAL ENGINEERING.—Modern Armor.—By F. R. BRAINARD.—The development of modern ship armor, from laminated sandwiched and compound types to the present solid armor.—9 illustrations..... 12829

X. PISCICULTURE.—Restocking the Seine with Fish.—The introduction of 40,000 fry of California trout and salmon, designed to restock the Seine, depopulated of fish by explosions of dynamite used in breaking up the ice.—1 illustration..... 12828

XI. RAILWAY ENGINEERING.—Improved Hand Car.—A novelty in the construction of hand cars, avoiding the production of a dead center.—1 illustration..... 12835

XII. TECHNOLOGY.—The Tanning Materials of Europe.—The natural tanning materials and pathological or abnormal growth tanning materials described and classified, with relative power..... 12837

ORIGINAL WORK IN AMERICA.

COLUMBIA COLLEGE, NEW YORK CITY.

Resuming the narrative of our inquiries: Seth Low, LL.D., President of Columbia College, said: "We at present are in an unsettled condition. Radical changes are taking place and entire reorganization is in progress; and so, with regard to what the professors in the college are doing in the way of original work, I am not just now able to speak. It is my opinion, however, that this is indeed an important function of the ideal university. The college, is concerned with pedagogics, with the work of teaching what is already known. The university is concerned with higher things than that. Its duty is to add to the sum of human knowledge. The college, of course, is the seed whence springs the university, but it is for the sake of the tree that the college exists. I do not mean by this to deprecate the work of undergraduate instruction. This is as essential, as honorable, a vocation as it has ever been. But for those members of Columbia's faculty who have given promise of good work in this field, it is our aim to secure the time and means whereby they can do original work in their respective branches. One of the great distinctions between a college and a university is the fact that the college concerns itself with teaching what is already known, while the university seeks to widen the domain of what is known and taught. In order to carry on this work in scientific investigation, a new system of fellowships has been established. After July 1, 1891, there will be twelve fellowships, after July, 1892, eighteen, and after July, 1893, twenty-four fellowships, each of the value of five hundred dollars a year. They are to be awarded by the president, with the advice of the University Council, to those applicants who give evidence of fitness to pursue courses of higher study and investigation, and the competition for these prizes is to be open to graduates of any college or scientific school. The fellows so appointed are to hold office for one year. No fellow, moreover, shall be permitted to accept remunerative employment except by permission of the president."

Elwyn Waller, A.M., E.M., Ph.D., Professor of Analytical Chemistry in the Columbia College School of Mines, said: "The work of original investigation in science at Columbia is not as extensive as we would wish for, owing to the fact that the time which ought to be devoted by the professors to research is taken up by the routine duties of instruction. This is true of all the departments in this school. There is a desire on the part of the officers to engage in this work, but we are all handicapped by lack of time. In spite of this, however, fairly good work is being done in several of the branches of natural science. In this department I have been engaged for some time with the study of lithia mineral waters, and the method of determining the presence of lithia in liquids bearing that name. As a result of my investigations, I have found that many of the liquids known and advertised as lithia waters really contain a very small quantity of this ingredient. A study has also been conducted in this laboratory of the determination of manganese and zinc as pyrophosphates. The plan for the determination of these metals after precipitation as carbonates, although very tedious and troublesome, has always been the favorite one with chemists. But a method involvless trouble has been called for, and to meet this demand, the precipitate of manganese as pyrophosphates has met with much favor. A question of great uncertainty has been the solubility of the precipitate in ammonium salts and the volatility of the precipitate in ignition. In order to reach some conclusion in this matter, three small quantities of pure zinc were weighed out and dissolved respectively in sulphuric, hydrochloric and nitric acid. The solutions were then diluted to known bulk, thoroughly mixed and aliquot portions taken for experiment. Precipitates of the solutions were then filtered and washed by decantation. Finally, when no reaction was given by the washings for phosphates, the precipitate by the aid of some nitric acid was dissolved and the solution filtered and poured into a weighed platinum dish; the zinc being rinsed into the dish with distilled water. The dish and its contents were then weighed, after evaporation and careful ignition. The object of this was to reduce the action of burning filter paper upon the precipitate, thus avoiding the consequent loss of zinc. The conclusion is that the disregard of this precaution and the consequent loss of zinc was the cause of the former opinion that the precipitate was partially volatilized on ignition. We have also been engaged in experiments on asphalt, for paving and other purposes. An apparatus has been devised to test the hardness of this substance; and many interesting experiments are being made in this comparatively new field."

Nathaniel L. Britton, E.M., Ph.D., Professor of Botany in the Columbia School of Mines, said: "I am engaged at present with the investigation of the flora of Bolivia, based on the extensive collections made in that country by Dr. H. H. Rusby, in 1885-1886, and the collections now being made there by Mr. Miguel Bang. I am also making a study of miscellaneous northern plants including the genera Lechea, Lespedeza, and Rynchospora. Mrs. N. L. Britton, voluntary assistant in the Botanical Laboratory, is now investigating the mosses of North America, based on the collections recently made by Mr. J. B. Leiberg, in Idaho. Dr. Morong, Curator of the Laboratory, is at work on the flora of Paraguay, based on collections made in that country by himself during the past three years. He is also making a study of the various North American plants with especial reference to aquatics, and a study of the order Halorageæ, a work now nearing completion. Among other studies, an important one is that now being carried on at the laboratory by Miss A. M. Vail, an interesting work on the North American species of the genus Desmodium. Besides this, study is being made of the North American species of the genus Polygala and the genus Xyris."

Ogden N. Rood, A.M., Professor of Physics in Columbia, said: "I have almost completed an optical investigation with the object of determining quantitatively the relative intensities of colored lights which are not complementary, also a study of the contrast of color, quantitatively. Besides this, my assistants are engaged on a number of subjects. Among these are: a study of the conducting powers of liquids for electricity, by means of the Kohlrausch method; an investigation of the methods of measuring the velocity of sound, and a study of the electrical resistance of contacts. No member of this department is engaged in any commercial or outside work whatever. There is one feature of work in which some college professors are accustomed to indulge, and which cannot be too strongly condemned. That is when a man under salary from a great university, trading on the name and fame of the institution, holds himself in readiness to testify as expert witness for a pecuniary consideration. This practice, I take it, is one which ought to be discouraged by the authorities of the colleges where it exists. The time of a college professor should be devoted to teaching and to original research, to the interests of the students, and the advancement of science. The office should not be prostituted in such a manner by self-seekers and mercenary men. There is, so far as I know, only one institution where this practice is not known, that is at Johns Hopkins. The only reason that makes such expert testimony valuable in the eyes of the jury is the fact that the witness is an officer in a prominent institution of learning; and this looks, to me, like trading in the reputation of the college, and a great breach of, to say the least, good taste."

PROGRESS OF STEAM ENGINEERING.

We have received from the Babcock & Wilcox Company a list of some of the high pressure boilers put out by them, which well illustrates the advances made within the last few years in the economies of steam engineering. The list gives the location of some seventy-five boilers, all of which are in constant use, carrying pressures of 200 pounds per square inch to 250 pounds and over. In one instance 300 pounds is regularly carried. These are mostly used for compound triple expansion and quadruple expansion engines. It shows that it is not only practicable but economical to carry such high pressures, if the engine plant is properly designed.

Theatrical Face Paints.

Torjesen gives the following formulæ:

White.—Oxide of zinc, subnitrate of bismuth, and plumbate of alumina—of each, 1 oz. Mix, and make into a paste with almond oil (5 to 6 drachms required), and perfume with 12 minims of peppermint oil, 12 grains of camphor, and a drachm of ess. bouquet.

Bright Red.—Oxide of zinc, subnitrate of bismuth, and plumbate of alumina—of each, 10 drachms; eosin, 2¼ grains, dissolved in a drachm of ess. bouquet; oil of peppermint, 12 minims; camphor, 12 grains; almond oil, a sufficiency to make a paste. Mix as above.

Deep Bordeaux Red.—Oxide of zinc, subnitrate of bismuth, plumbate of alumina—of each, 15 drachms; oil of peppermint, 12 minims; camphor, 12 grains; carmine, 30 grains (dissolved in 80 minims of solution of ammonia); almond oil, a sufficiency; ess. bouquet, 1½ drachms. Mix.

Skin Color.—Vermilion, 3 drachms; tincture of saffron, 2 drachms; powdered orris, 5 drachms; precipitated chalk and oxide of zinc, of each, 20 drachms; camphor, 20 grains; oil of peppermint, 20 minims; ess. bouquet, 1½ drachms; almond oil, a sufficiency. Mix.

Black.—Drop black (made by burning camphor and washing the soot with spirit), 2 drachms; almond oil, 2 drachms; cocoanut oil, 6 drachms. Mix, perfume, and cast into sticks.

It Pays to Advertise in the Scientific American.

In a recent letter to the publishers of this paper the Felt & Tarrant Manufacturing Company, of Chicago, writes:

"We hardly think it advisable to change our advertisement in the SCIENTIFIC AMERICAN, as the present wording brings us a constant stream of inquiries and numerous sales. It has brought us orders direct from South America, Brazil, Mexico, Peru, India, and all principal countries of Europe, and is by great odds the best advertising medium we have yet found."

© 1891 SCIENTIFIC AMERICAN, INC.

The Influence of Different Foods and Medicines Upon the Human Gastric Juice.*

BY DR. WOLFF.

The author in making a series of experiments upon the influence of various articles of diet and medicine upon the gastric juice first ascertained the ordinary amount of acid present in the stomach of the person experimented upon and the time of its disappearance after Ewald's test meal, consisting of a roll weighing about an ounce and a quarter and ten ounces of water, and used the results as a standard for comparison.

When certain quantities of alcohol were added in the shape of 50 per cent cognac or Munich beer, the conclusion arrived at was that small quantities of alcohol, about 20 per cent, have a slight power of raising the HCl secreted, but in larger doses, 30 per cent or over, they hinder the secretion and peptonization. Besides, the experiments seem to show that, when regularly used, the stomach, after a time, fails to respond to its usual stimulus, the food; the required amount of stimulant becomes greater, the use of alcohol more frequent, the glandular function of the stomach becomes more and more affected, and the way is opened to the whole train of dyspeptic symptoms, ending at last in atrophy.

Concerning the influence of coffee in infusion, he can give no information, because the color of the beverage interferes with the reaction of color tests. He substituted, therefore, caffeine, which he administered in the form of powders along with rad. altheæ. The result is that in doses of 20 cg., and still more in larger quantities, it has the property of lessening the total acidity at the height of indigestion; it also lessens the secretions of HCl, and delays peptonization. Since that amount of caffeine exists in the quantity of coffee taken usually by men, and more especially by women, we may assume that it has a similar action upon them.

Nicotine was next experimented with, a certain quantity—one mg.—being introduced by the sound after a test meal. Only three patients were tested, and of these, in two cases, there was a very slight rise in the acidity; in the third, a slight rise also at first, but after several days' use a material lessening of the secretion and delay in peptonization. The experiments are admitted to be too few to draw safe conclusions from.

Turning to the action of bitters on the secretion, Dr. Wolff refers to the experiments of Tschelzoff on animals, and Jaworski on men, which show that these drugs lessen the secretion of acid to such a degree that Jaworski attributes the commonly supposed beneficial employment of them in dyspepsia to their influence in lessening the acidity where hypersecretion exists. Wolff tested first the action of nitrate of strychnia in doses of 0·5–1·5 cg. The effect was found to be that where the acidity was below the normal, strychnia considerably raised it, but where HCl was habitually absent, the drug failed to call it forth. Infusion of cundurango seemed to have no, or very little, influence on the acidity, but a slight increase of the secretion of pepsin may be produced. Reichmann's experiments, a review of which was published in the *Chronicle*, gave nearly the same result. Bitter infusions poured into the fasting stomach produced less secretion than plain water, but when administered along with food, the bitter quickly disappears, and the secretion is afterward considerably increased; where, however, alkaline or neutral juice is ordinarily present, bitters are unable to provoke the secretion of HCl.

Three persons were experimented on with 15 to 20 c. cm. of ox gall, administered along with a test meal. It was found that the acidity was thereby lessened, but there was no considerable diminution of the HCl or hindrance to peptonization.

Administering 5 g. of common salt with the test meal to patients either with lessened or increased secretion of HCl invariably lessens the amount of HCl present, in cases of hyperacidity to one-half, with a corresponding improvement in the symptoms. The beneficial action of such waters as Wiesbaden and Kissingen must therefore be chiefly attributed to the lessening of the secretion of HCl, but their influence on absorption and the motor function of the stomach may be beneficial, and that on metabolism generally must not be neglected.

The author cites, before making experiments of his own on the action of Carlsbad salts, the results of the latest experiments of Jaworski, that "small quantities of Carlsbad water or salt stimulate the secretion of acid and the digestive activity, but when used in large quantity they stop the secretion and digestive power for several hours; that under this medication from day to day the activity of secretion and digestion constantly diminish, and at last the sensibility of the stomach to irritants is lessened to such an extent that no kind of food suffices to produce acid and frequently not even pepsin secretion." Ewald found, however, that in ten persons subjected to a course of thermal water, and tested at frequent intervals during the time, half had slightly lessened acidity, the other half increased, and the lessening occurred in those who before the treatment had a high acidity. Jaworski has also found borax to act primarily as an irritant in small doses, but in large doses it causes a lessening or total drying up of the secretion.

Wolff, on the ground of the experience obtained of the action of common salt, Carlsbad salt, and borax, has administered a powder of the following composition in cases of hyperacidity, with or without hypersecretion, with great success: Sulphate of soda, 30 g.; sulphate of potass., 5 g.; chloride of soda, 30 g.; carbonate of soda, 25 g.; sodæ bibor., 10 g.; half a teaspoonful three times a day, in half a glass of lukewarm water, fasting, and two hours before dinner and supper. In a typical case of hypersecretion the quantity of fluid in the fasting stomach was reduced, by four weeks' treatment, from 50 c. cm. to a few cubic centimeters, and the acidity, at the height of digestion, by one-third.

Referring to the influence of acids on the secretion, Wolff found that when hydrochloric acid was administered to three patients in whom it was habitually absent, for periods of eight days, there was not in a single case any distinct action on the HCl secretion. A distinction ought to be made, perhaps, according to the results of Jaworski's experiments, between ordinary acids and carbonic acid, since the latter exercises a purely mechanical influence, and in some raises the acidity considerably, and increases the peptic power of the gastric juice.

* Abstract of paper published in *Zeitschr. f. klin. Med.*, from the *Medical Chronicle* for August.

Dangers of Pharmacy.

Mr. George Weddell contributed lately a paper on this subject to the Newcastle-on-Tyne Chemists' Assistants' Association. The full title of Mr. Weddell's paper was, "Some Dangers of Pharmacy in Storing, Handling, Manufacturing, Dispensing, and Selling Dangerous Drugs and Chemicals." In this paper he said he was only opening a rather extensive subject. He had been favored with assistance from Mr. Atkins, of Salisbury; Dr. W. Inglis Clark and Mr. Dott (Duncan, Flockhart & Co.), Messrs. Smiles and D. Mackenzie (T. & H. Smith & Co.), and Mr. Peter Boa, of Edinburgh; Mr. Lane (Woolley, Sons & Co.), Manchester; Mr. Martindale, Mr. C. Umney, and the editor of the *Chemist and Druggist*, London; also from his local *confreres*, Messrs. Bambridge, Clague, Park, and B. S. Proctor; and from Mr. Linford (Lofthouse & Saltmer), Hull. Mr. Weddell said it was impossible in a single evening to go thoroughly into all the dangers of pharmacy, but promised that if members of the calling would assist him by sending him their experiences of danger, whether physical, chemical, physiological (poisons), or legal, he would, when leisure permitted, bring the matter in a more or less compact form before the general body of chemists and druggists. He also asked them to consider nothing too commonplace, or, on the other hand, too uncommon, to be communicated, and promised due acknowledgment to contributors. The points on which he invites information are dangers incurred in:

Storing, Handling, Manufacturing, Dispensing, and Retailing

- Inflammables. (Also notes on Spontaneous Combustion.)
- Explosives.
- Corrosives.
- Poisons: Vapors, Liquids, and Solids.

The following are among dangerous substances and compounds mentioned by Mr. Weddell:

INFLAMMABLES.

Mixtures of H and O.	Ethers.
Cotton wool (near gas).	Ac. carbolic (in liquefying).
Sugars (in sirup making).	Fats and oils.
Spirits (in heating or measuring near light).	Carbons?
	Hydrocarbons.

EXPLOSIVES.

Siphons of aerated water.	Argent. oxid.
Potass. chlor. (powdered in iron mortar, or trampled under foot on floor).	Phosphorus, amorphous.
	Picric acid and picrates.
Mercuric oxalate (in powdering).	Nitroglycerine.
Argentic oxalate (in powdering).	Sulphur hypochlorite (in tapping stopper).
Fulminates of silver and mercury.	Hypophosphites (in powdering).

MIXTURES.

Pot. chlor. c. antim. nig.	Pot. bichrom. c. alcohol.
" c. hypophosphites.	Pil. phosphori.
" c. glycerine.	Sp. terebinth. c. H_2SO_4.
" c. ammon sulphuret.	Iodine and iron.
" c. morph. mur.	" and liq. ammon. fort.
" c sulphur.	Nitrate of lead and charcoal.
" tannin.	Ac. chromic. and glycerine.
Pot. permang. c. glycerine.	Strong acids and glycerine.
" c. alcohol.	Tr. nucis vom. c. acid. nitromur. dil. (burst).
" c. fe. redact.	

CORROSIVES.

Sulphuric acid (spurts if water added to it instead of it to water. What application?)	*Chromic acid.*
	Chlorine.
	Bromine.
Nitric acid. (What application?)	*Hydrofluoric acid.* (Application?)
Nitric acid fumes. (What application?)	*Sodium.* (Application?)
	Phosphorus. (Application?)
Hydrochloric acid.	*Caustic soda.* (Application?)

POISONS

of various kinds were mentioned by the author, with precautions to be observed; and also a number of dangers of various kinds to be guarded against at the retail and dispensing counters, such as transposition of labels on liniment and mixture bottles; labeling strong drugs "Poison," or "With caution," even (when for internal use) in giving customers what they ask for; protest or caution, if necessary; badly dried bottles for kali; when temperature rises, see to stoppered bottles, in case they burst; volatile liquids not to be kept on a high shelf; carbon bisulph., etc.; powdering chrysarobin, corrosive substances, plumbi acet., potass. cyanide, etc.; a mixture of calomel and gum forms a cement; in pills, danger of not having active ingredients (strychnine, ext. physostigmatis, etc.) thoroughly mixed; putting nitric or other strong acid in dirty bottle (turpentine, etc.); using distinctive bottles for external applications.

In closing, Mr. Weddell briefly touched on the legal dangers which beset the unwary pharmacist, such as drugs not up to requirements (Sale of Food and Drugs act); drugs under common names (citrate of magnesia, milk of sulphur, sweet spirit of niter, etc.); sale of S.V.M. on Sundays; sale of same for drinking or without license; use of same in preparations capable of being used internally; use in patent medicines (although unknown to seller); use of still without license, or for methylated spirit preparations; sale of medicated wines without license (if capable of being used as a beverage); acting as an apothecary (do not take pay); ships' medicine chests (not to requirements); stamp duty; poisons not labeled, or insufficiently so; sale of medicines capable of being used for improper purposes; buying goods dishonestly acquired, etc.

Chicago Exhibition, 1893.

The Exhibition is to be opened on the 1st of May, 1893, and closed on the 30th of October. All governments have been invited to appoint commissions for organizing the foreign sections. The duties of these commissions will be the same as in previous international exhibitions, applications for space having to be addressed to the commission of the country where the article is produced. The general reception of articles at the Exhibition is to commence on the 1st of November, 1892, and no articles are to be admitted after the 10th of April, 1893; but special installations will be permitted to be commenced as soon as the condition of the buildings allow. Products intended for competition must be so described; if not, they will be excluded from examination by the juries. The official catalogue is to be in English, French, German, and Spanish. The following are the twelve divisions of the classification:

A.—Agriculture, forest products, forestry, machinery and appliances.
B.—Viticulture, horticulture, floriculture.
C.—Live stock—Domestic and wild animals.
D.—Fish, fisheries, fish products, and apparatus for fishing.
E.—Mines, mining, and metallurgy.
F.—Machinery.
G.—Transportation—Railways, vessels, vehicles.
H.—Manufactures.
J.—Electricity.
K.—Fine arts—Pictorial, plastic, and decorative.
L.—Liberal arts—Education, engineering, public works, architecture, music, and the drama.
M.—Ethnology, archæology, progress of labor and invention, isolated and collective exhibits.

A limited amount of steam and water power will be supplied gratuitously. Power in excess of that allowed gratuitously will be furnished at a fixed price.

Value and Importance of Trade Marks.

In these days of bitter trade competition and price cutting, the value of patents and trade marks is much more appreciated and sought after than heretofore. In many cases a trade mark is the foundation of great enterprise and the principal grounds for success. A trade mark is any arbitrary word, sign or symbol applied to goods placed for sale on the market. The adoption of a trade mark and the application of the same to the goods immediately creates a common law right therein, which the proprietor may and does hold exclusive to all others. The principal requirement to constitute a right in a trade mark is that the word, sign, or symbol shall be applied to goods placed on the market. One cannot appropriate a trade mark by simply publishing the fact that he or they contemplate the use thereof.

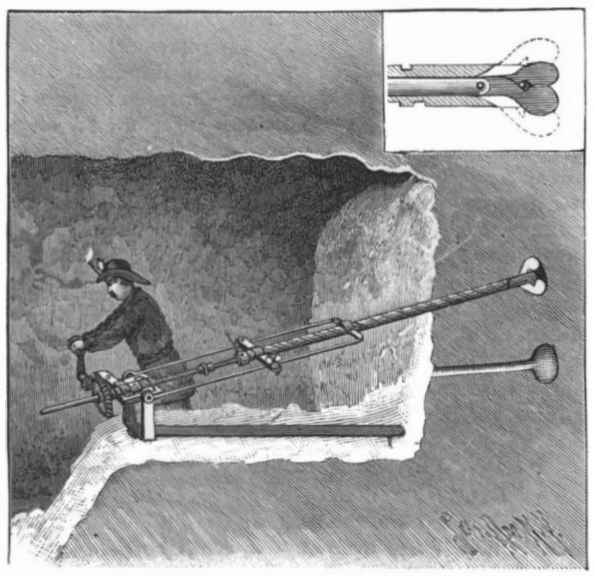
They should place the mark on the goods, or otherwise no right arises. Trade marks are allowed to be registered in the United States Patent Office upon the payment of the government fee of $25 and filing certain fac-similes and an application. They are registered for thirty years, with the privilege of a renewal for like periods upon the payment of the fee required.

It will be seen that a trade mark protection is practically unlimited as to time. There have been some thirty-odd thousand trade marks registered in the Patent Office and the number of yearly registrations is continually increasing, which illustrates the fact that the community is becoming more convinced that trade mark protection is of great importance and very beneficial to the proprietors.—*Hardware and Metal Review.*

© 1891 SCIENTIFIC AMERICAN, INC.

A DRILL TO FACILITATE BLASTING.

The illustration represents a drill specially designed for boring into coal banks, and adapted to form at the end of the bore a pocket for the reception of a large amount of powder, thus increasing the effectiveness of the blast and lessening the liability of blowing out the tamp. A bar or base piece has on its under face near one end a spur adapted to be driven in a proper supporting position, and near the outer end of the bar is pivoted a yoke having sockets in which is held a horizontal guide box. The latter is made in hinged sections, which, when locked, form channels for the reception of a drive shaft having a longitudinal face



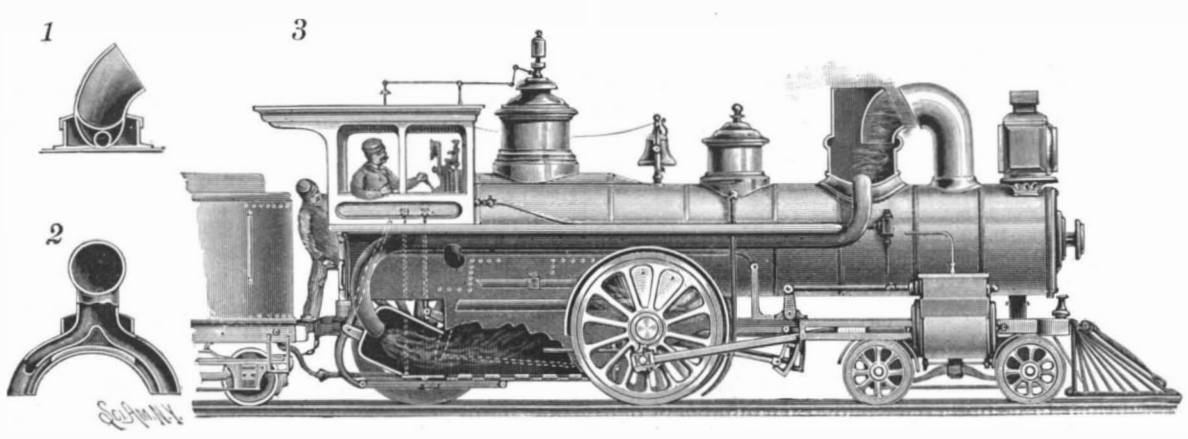
WATTS' POCKET-FORMING DRILL.

groove, and a polygonal socket at its forward extremity. Connected with the drive shaft at the rear of the guide box is a spur wheel meshing with a pinion, through which, by means of a crank, the shaft is revolved. The extremities of an elongated U-shaped frame are pivoted on the trunnions of the guide box, and upon this frame is a hinged sliding clamp, with a clamping screw to draw its members together. The clamp has central channels adapted to receive the circumferential recessed surface of an externally threaded bit rod casing, which also has a spiral external groove extending nearly from end to end. The bit, held in the outer end of the casing, consists of two members having approximately circular heads with outer cutting edges, and integral shanks pivoted to the outer end of a bit rod, as shown in the small figure, the rod being capable of longitudinal movement in the casing, and its other end being connected with the forward end of the drive shaft. When the hole is being drilled the members of the bit overlap one another, and extend but a slight distance beyond the casing, but when the hole has reached the desired depth, the thumb screw of the clamp is tightened to prevent the further forward movement of the casing, while the bit rod is forced outward by the further operation of the drive shaft, causing the bit members to expand to form a pocket at the end of the bore, as shown in dotted lines in the small view. The chips produced in the operation escape through the spiral groove of the casing.

Further information relative to this invention may be obtained by addressing the patentee, Mr. Julius R. Watts, in care of McCullough Bros., No. 124 North Fifth Street, Springfield, Ill.

A LOCOMOTIVE SPARK ARRESTER.

The illustration represents a construction designed to prevent the sparks and cinders of a locomotive from falling upon a train or surrounding lands and buildings, while also facilitating the more complete combustion of the fuel. It has been patented by Mr. Edson J. Hadlock, of Big Spring, Texas. The smoke stack is curved rearwardly, and a spark arrester of the same height as the smoke stack fits upon a box at its rear. The spark arrester is divided by a curved partition into two chambers, the opening of the forward chamber being in horizontal alignment with the nozzle of the smoke stack, while the rear chamber opens into the air, and both chambers communicate with the box below. This box has a double deflector, raised in its central portion, and opening from each side of the box are pipes which extend along each side of the boiler to a point of discharge in a cinder box beneath the cab. Each of these pipes also has a branch opening communicating with the fire box, but these openings are not used at the same time with the openings in the ends of the pipe. Pivoted in the bottom of the cinder box is a damper, a rod from which extends upward into the cab. In the bottom of the ash pan are transverse slots, while there are corresponding slots in a slide adapted to be operated by a lever extending up into the cab, whereby the cinders and ashes may be dumped at convenient points. At the rear end of the ash box is a damper adapted to be operated, through a bell crank, from the cab. It is designed that, with this invention, the ordinary dampers may be dispensed with, sufficient air being admitted through the dampers in the cinder box and at the rear of the ash box. Figs. 1 and 2 represent a modified form of the arrester, attached by flanges to the supporting box on the top of the boiler, the smoke in this form of arrester all passing through the branch pipes into the fire box. In the form shown in Fig. 3, the heavier portions of the smoke are designed to pass downward, while the lighter parts may pass upward from the rear chamber of the arrester.



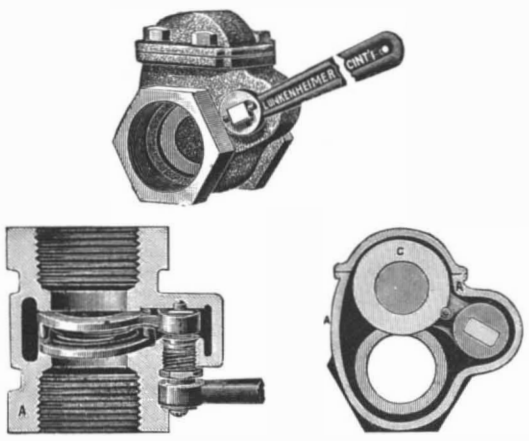
HADLOCK'S SPARK ARRESTER

Cement which Resists Acids.

The following substance, it is said, will protect cement from the influence of acids: Melt together carefully one part of caoutchouc (India rubber) with two parts of linseed oil, and gradually incorporate with it three parts of white bole, so as to form a plastic mass. This cement is not at all attacked by hydrochloric and but very little by nitric acid. When heated it softens but very little. It does not easily dry upon the surface. *New Remedies* says, if this cement is mixed with one-fifth of its weight of litharge or minium, it dries up in the course of time and becomes hard. This is known as Benicke's cement.

AN IMPROVED GATE VALVE.

The valve shown in the illustration is especially designed for low pressure steam, water, gas, oils, etc. It is a double disk straight-way valve, operated by a lever instead of a wheel, the position of the lever indicating the opening of the valve. The disks are secured to the operating stem and adapted to close against tapering seats in the valve shell, and, having ball and socket



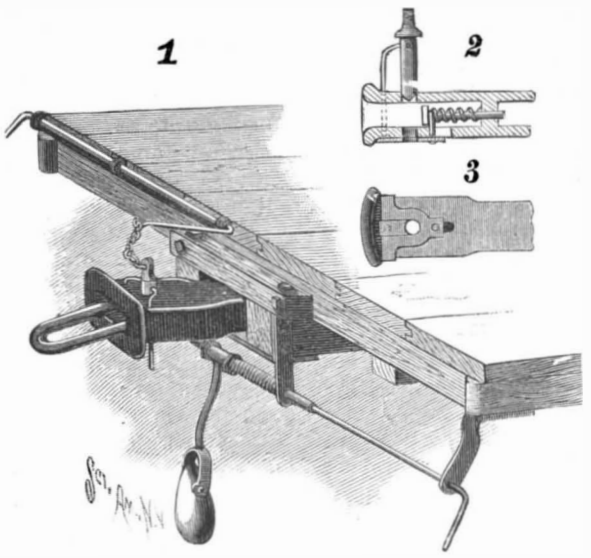
LUNKENHEIMER'S "HANDY" GATE VALVE.

bearings at their back, are evenly wedged against their seats when the valve is closed by the lever. The stem has a tapering flange upon which bears a non-rotating friction washer. This valve is manufactured by the Lunkenheimer Brass Manufacturing Company, of Cincinnati, Ohio, and this company, in addition to its former facilities, has recently purchased the entire plant of the Porteus Manufacturing Company, of the same city.

IT is estimated that in the year 2000 no less than 1,700,000,000 people will be speaking the English language, while only 500,000,000 will be speaking other European tongues. English is thus indisputably the language of the future.

AN IMPROVED FREIGHT CAR COUPLER.

The illustration represents the application of novel attachments to facilitate the coupling of freight cars, without it being necessary for the trainmen to go between the cars, while the construction is such as to be readily applicable to the drawheads now everywhere in use. In the rear of the drawhead opening, as shown in Fig. 2, a coiled spring surrounds a rod having a downwardly extending lug, adapted to move forward and backward in a slot in the bottom of the drawhead. The projecting end of this lug is connected to a movable shoe plate, shown in Fig. 3, and the forward end of this plate is adapted to cover vertical openings in



MARSHALL'S CAR COUPLER.

the drawhead in addition to the regular pin openings. The coupling pin is raised by a lever, whose outer end extends to the side of the car, where it has a handle, the lever being connected to the coupling pin by a short chain. On the coupling pin are forwardly extending vertical arms, adapted to fit within and work through the additional vertical openings, and to rest upon the shoe plate. Normally these arms hold the coupling pin in elevated position, as shown in Fig. 2, but when the shoe plate is moved backward by the entrance of an opposing coupling link, and its pressure against the spring, the pin-supporting arms are released and the coupling pin drops, thus effecting the coupling. The sliding shoe cannot then be moved forward until the coupling pin has been raised to its full height by means of the lever at the side of the car. In order to hold the link in line with the drawhead opening of an opposite car, as shown in the general view, Fig. 1, an operating lever is secured in proper position in suitable hangers, the outer end of this lever having a handle, so that it may be operated from the side of the car. Upon this lever is secured a rod, in the forked lower or outer end of which a weight is pivotally held, the upper end of the weight being of a shape to enter the opening of the loop. Upon the lever, between collars attached thereto and the inner hangers, are spiral springs, permitting the lever to be moved a little to one side or the other when the link hangs at either side of the center line, the link being thus conveniently held in position by the operator at the side of the car. The slack deemed essential in starting and hauling heavy trains is not sacrificed in the use of these attachments, the connections between the cars remaining as at present.

For further information relative to this invention, address the patentee, Mr. J. E. Marshall, Martinez, Cal.

A Gas and Smoke Helmet.

An apparatus likely to be useful in gas works in cases of emergency when valves have to be closed or repairs effected in an atmosphere charged with either coal or carbonic acid gas, or thick smoke, is Kleeman's respirator. The appliance consists of a leather helmet, a bellows, and a hose for connecting the helmet with the bellows. The helmet fits tightly over the head, having a visor with glazed sights very much like an ordinary diver's helmet, only of course much lighter and differently fitted. The fresh air enters the mouthpiece, by means of a suitable connection with the hose; flows round the face and head of the wearer; and finally escapes through a valve on the top of the helmet. The necessary adjustments are very simple; so that any one can learn how to use the appliance after a short trial. The weight of the helmet is only 2½ lb., and it is stated that it does not interfere in any way with the movements of the wearer. Since the head is wholly protected by the helmet, the eyes are not incommoded by smoke or acid gases. The bellows are, of course, to be worked in pure air at a distance by an assistant; but the whole arangement is naturally lighter and handier than diving apparatus.

IRON rusts readily in all locations when alternately cold and hot, but particularly with a porous material which prevents the moisture from evaporating freely.

© 1891 SCIENTIFIC AMERICAN, INC.

THE PROPOSED HUDSON RIVER SUSPENSION BRIDGE.

(*Continued from first page.*)

It comprises trusses, also of 55 feet height, to accommodate the decks.

A wind pressure of 50 pounds to the square foot has been assumed as a basis for the calculations, and to resist it two horizontal trusses, 115 feet deep, extending continuously from anchorage to anchorage, are provided. This represents the space afforded for the decks, which are of this total width, being a few feet less in the clear.

Of these decks there are to be three, although it is designed to construct only one of them at present. The lower one is to carry for the present six and ultimately eight tracks for regular railroad service. On the second deck there are to be four rapid transit tracks and there is room for two additional heavy service tracks. The third deck is to afford a promenade twenty feet wide. It seems a pity not to arrange a roadway for carriages, as it would afford a most impressive drive, but the approaches for such roadway from the low ground on either shore are considered impracticable, and the ferries are relied upon as more convenient for wagon traffic.

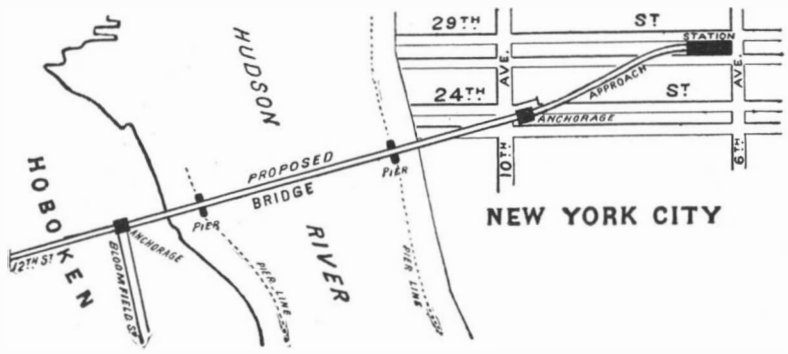
As regards the question of height, this is limited by the necessity of preserving a proper grade. At the height of 135 feet, as originally proposed, at 60° F. the grade upon the New York side is 1·9 per cent, or 95 feet to the mile, and on the New Jersey side 1·4 per cent. The heavier grade is more than is desirable. The middle span, in order to keep the grade low, is restricted to a rise or camber of not more than 19 feet. Shipping will be to some extent inconvenienced by the lower height, but it is stated that last year only seventeen ships lowered their upper masts to pass under the Brooklyn Bridge.

The New York station is to be in the neighborhood of Sixth Avenue, above Twenty-third Street. It is to be 1,300 feet long, and is to include a 400 foot loop for drilling trains. The approaches to the anchorage will be largely of stone and brick. On the New Jersey side the approach will extend across Bergen Hill through an open cutting. At the two anchorages passenger elevators will be provided, giving access to the foot promenade.

The future work of the bridge is based upon the present traffic from the New Jersey shore. Daily, over 150 express and 680 local trains arrive at and depart from this locality. The Hudson River ferries carry now fifty-two million passengers annually, and it is believed that thirty millions of these would use the bridge during the first year of its existence. It must be remembered that it may take ten years to complete it, and that the traffic will be increasing meanwhile.

Again, as regards its capacity, it is found that the New York elevated railroads carry one hundred and eighty millions of passengers annually on eight tracks, and the Brooklyn Bridge carries thirty millions on two tracks. There is to be no restriction on speed on the Hudson River Bridge, so that its capacity *pro rata* will be still greater.

The government and direction of the company is vested, by the act of Congress authorizing the building of this bridge, in a board of seven directors. The president of the company is Mr. Jordan L. Mott, of New York, and the other directors are Edward F. C. Young, of Jersey City; Thos. F. Ryan, Charles J. Canda, and Wm. Brookfield, of New York; James Andrews, of Allegheny, Pa.; and J. K. McLanahan, of Hollidaysburg, Pa.



SUGGESTED LOCATION OF BRIDGE ANCHORAGE STATION AND APPROACHES.

The Deepest American Well.

An 8 inch well which is being sunk near Wheeling by the Wheeling Improvement Company, in a search for oil or gas, has reached, after several months of boring, a depth of 4,100 feet. Both oil and gas have been struck throughout in paying quantities. It has gone through several thick veins of coal, and has traversed layers of gold quartz, iron and numerous other minerals.

Professor J. C. White, State Geologist, who has watched the drilling closely, has succeeded in getting the government interested in it. The result is that after the well has been sunk to the depth of one mile the government will take up the work, and, under the direction of expert officers of the Geological Survey, drill into the earth as far as human skill can penetrate.

The temperature and magnetic conditions will be observed as far as possible, and, by means of an instrument constructed for the purpose, a complete record of the drilling and all discoveries made will be kept. This record will be placed in the Geological Survey's exhibit at the World's Fair and afterward preserved at Washington. Professor White and the government officers state that this will be one of the most novel and important exhibits at the Fair and will attract the attention of the scientists of the world.

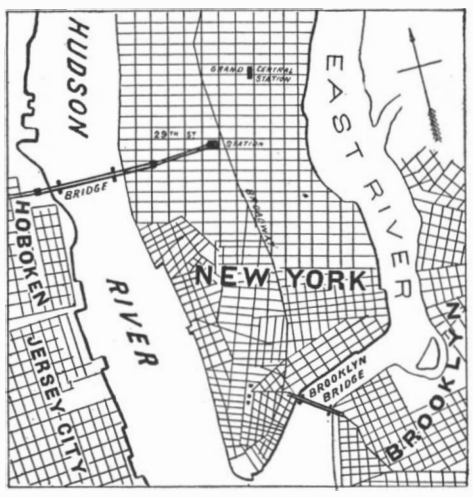
IRON corrodes with great rapidity at or about the temperature of boiling water.

Something about Gas Pipes.

The following is from a recent discussion by the N. E. gas engineers:

"What is the smallest size cast iron pipe that it is policy to lay?" The answer was: Nothing smaller than 4 inches in the streets. As to material, Mr. Nettleton said: Much wrought iron pipe is being used for mains through the West, up to 6 inch pipe, particularly in the smaller towns and cities. While they admit that the cost of the pipe is somewhat more, yet they think there is an economy in using it (although it has not been employed long enough to determine the fact), in two ways: First, by the leakage, because the pipe can be made absolutely tight; second, in the cost of laying, for the lengths can be screwed together very much faster, and at a very much less cost, than cast iron pipes can be put together in the ordinary way. Mr. Lamson thinks they will have trouble in the end. In small towns it will not be so bad as in cities, but in cities if you lay wrought iron pipes where you are liable to have the ground saturated after a time with urine from horses, the deterioration of wrought iron pipe will be found to be something very considerable. Cast iron pipe will stand it, wrought iron pipe will not; trouble will surely follow.

As to putting wrought iron pipes in the ground, Mr. Shelton said: If I were going to lay such pipes, I would coat them. I think the trouble with wrought iron pipes, by reason of their too rapidly giving out, can be overcome in this way. The company I am connected with adopted some years ago the standard coating used by General Hickenlooper, of Cincinnati. I think some 10 or 12 years ago he looked into that question and formulated a recipe for coating service pipes, which he adopted as a standard, and has used ever since. He claims that the services last indefinitely. Hence the coating is very satisfactory. It was satisfactory enough to cause us to adopt it as our standard, and our rule is that no service pipes shall be laid under any circumstance without being coated. It is a solution of rubber, tar, lime and turpentine. It is easily made at the works, and the men can dip enough pipe in a single afternoon to last them for a year. When they lay the pipe they have only to carry the pitch along with a brush, so that whenever the tongs make any nicks in the coating, just before filling in the



MAP OF NEW YORK CITY, SHOWING LOCATION OF HUDSON RIVER BRIDGE.

earth, they can coat it by hand. I do not see why that should not apply to wrought iron pipes of large size. It certainly pays to prepare them in small sizes in that way. I am myself a believer in wrought iron pipe. I think we are coming to it. We would be surprised at the amount of wrought iron pipe used in the West, as Mr. Nettleton says; but they have to be coated in some way. You can save leakage and can make them absolutely tight. You can lay them quicker, and I think that, by using a coating, eventually, wrought iron pipes will be the thing.

Leaded Pipes. — A firm in Philadelphia says: "Wrought iron service pipes may be lead-coated and rendered proof against rust or decay from dampness, or from passing through soil having an affinity for iron, which in many cases eats out a service pipe in a few months, swelling the leakage account considerably before the fault is discovered. Sheet iron for roofs and sides of buildings may be lead-coated and protected against the action of the smoke and gases in the generator and purifying houses, and being equally proof against rust from the action of the weather outside, affords a valuable addition to the buildings of a gas plant. We have coated materials for service pipes for gas companies, roofs, smoke stacks and car roofs for railroad companies, and for roofs for buildings for iron furnaces, and in these most trying positions our lead coating has been entirely satisfactory."

Galvanized Pipes.—Mr. Allyn said: "Any one who has had experience in using galvanized pipe must know there is a serious objection to it, while at the same time it certainly has its advantages. We have used nothing for our services for the last twelve years but galvanized pipe, but we often find a lot of pipe in which the fiber of the iron is entirely destroyed by the action of the zinc in galvanizing the pipe. A year or two ago we had a lot of pipe, mostly 1½ inch, which was rendered so brittle that as soon as the cutter wheel commenced cutting it the pipe flew apart like a piece of glass. We often find pipe in which the galvanizing has been improperly done, or put on at too low a temperature, and we occasionally find pipe which is filled nearly one-half with the zinc oxide of the pipe."

Liquid Fuel.

At a recent meeting of the Shipmasters' Society, London, a paper was read on "Liquid Fuel in Ocean Steamers," by Captain W. V. Carmichael. Premising that the question of liquid fuel in steamers was not a new one, the lecturer stated that, partly owing to the cheapness of coal, and partly to the timidity of owners to adopt it, the use of oil fuel had not been much taken up by steamship owners.

Now however the aspect of affairs was changing. By the use of petroleum he stated that the fires were completely under the control of the engineer on watch, who would regulate them so as to have any pressure of steam he required, without being dependent on his firemen. The great advantage of oil fuel to the shipowner was that he could carry his fuel in a space that was now wasted, namely, a cellular bottom of the ship, or in ballast tanks. As the consumption of oil, compared with coal, was, weight for weight, one half—ten tons of coal, in other words, being only equal to five of oil—the storage of fuel could be made much more compact and easier of access; there was increased speed in fueling the ship; and port charges were avoided, as more fuel could be carried in proportion than formerly. Petroleum was known to exist in all parts of the habitable globe, and it was hardly probable that competition would not bring the fuel within easy reach of the commercial world.

For many reasons oil fuel was of more value to torpedo boats and ships of war than it probably was to merchant steamers. As to the question of fueling our men-of-war at sea during a blockade, he thought that the large tank steamers of the present day could always fuel the fleet even in heavy weather. He maintained that the oil was perfectly safe while on board ship; that it could be stored on shore easily, and in the event of a fueling port being bombarded, shells could not set fire to the tanks; and it could be handled without risk of fire or explosion from the shore to the ships, or *vice versa*.

His object in reading the paper had been to allow the mercantile world in general, and the members of the Shipmasters' Society in particular, to know the progress oil fuel was making; the comfort it was to engineers and all concerned; its pecuniary advantages to the merchant who could avail himself of it; its peculiar adaptability to ships of war; and its special value to large, first class passenger steamers, where cleanliness and the comfort of the passengers were desired. It could be adapted to any boiler, either afloat or ashore.

Water Power Lighting.

The village of Faido, on the line of the St. Gothard Railway, has an electric light plant, erected within the past year, in which water power is used to drive the machinery. The water is stored in a reservoir, above the falls of the stream near the village, and thence is led to the power station through a 6 in. cast iron pipe. The power station is equipped with a turbine, which, with the available head of 145 meters—about 475 feet—develops about 45 horse power. Two constant current dynamos are used, furnishing a current of 160 amperes and 140 volts. One of them only is used in the ordinary work, the other being held as a reserve. The village is lighted by 360 incandescent lamps, working at 120 volts. The street lamps have about 25 candle power each; those in private houses range from 16 to 25 candle power, and those at the railway station from 16 to 32 candle power.

ONE dollar a minute is the charge for using the new telephone line between London and Paris. Distance about 280 miles. Forty cents a minute is the price between New York and Washington, about 240 miles.

© 1891 SCIENTIFIC AMERICAN, INC.

Historic Spoons, the Latest Fad.

This is an age of spoons—historic spoons. The *Board of Trade Journal,* Providence, R. I., gives a list of the historic designs which many bear. In Salem, a former dwelling place of witches, the first historic spoon appeared. This spoon, or perhaps the idea, was received with such favor that other spoons came forth.

In this country there are many "collectors." They collect anything, from post stamps to middle-aged armor. Some collect one thing and some give their attention to several things. When historic spoons began to appear, collectors sprang up. They were delighted. Ah, here was something new—spoons, historic spoons of sterling silver and worth. How interesting a collection of spoons all different, and every one a memorial or a reminder of some event of great historic worth.

Manufacturers of spoons saw their opportunity and improved it, and the result to-day is that many spoons are bidding for money in towns and cities from Maine to California. The spoon in Plymouth, of course, is a "Mayflower spoon." In Hartford the Charter Oak is recalled by a spoon with the oak engraved on the handle. Portland, Oregon, has a spoon, design unknown. New Orleans has a spoon with cane stalks, a crane, and a cotton bale as embellishments. Portland, Me., engraves the historic observatory on a spoon. The Springfield spoon bears the likeness of Miles Morgan, a pioneer. Chelsea's spoon honors Winnisemmet, a friendly Indian who owned Powder Horn Hill, and sold it for a horn of powder. A powder horn is shown on the spoon. It is a leading spoon.

New York has a spoon to revive and perpetuate Knickerbocker history, and one to honor Rip Van Winkle. Washington has two spoons, one showing the executive mansion and one on which the Washington monument is engraved. Of course the Mount Vernon spoon shows the home of Washington. Pittsburg's spoon has an oil derrick and a gas well for ornament. St. Paul combines the falls of Minnehaha and old Fort Snelling on the handle. Milwaukee honors its founder, Solomon Janeau. In Boston there are several designs. The first showed Paul Revere's ride. New London, Conn., places on her spoon a sketch of an old mill, and pays no attention to Pequot history. Lynn's spoon is ornamented by Moll Pitcher and her black cat. The Portsmouth spoon commemorates Wentworth mansion. An "Old Man of the Mountain" spoon is another New Hampshire design. The spoon from Manchester bears the portrait of John Stark, the hero of Bennington. Worcester places Bancroft's face on its spoon handle. Four spoons show how the poet Whittier is esteemed. Haverhill gives his birthplace, and Amesbury his residence, the "Captain's Well," and a "Whittier Head."

Portland, Me., the birthplace of Longfellow, places a medallion portrait of the poet on a spoon, and has also a Priscilla spoon, a Miles Standish spoon, and a Hiawatha spoon. Providence has its Roger Williams spoon.

New Armor Trial.

An interesting test of armor has recently taken place on the Naval Ordnance Proving Grounds at Annapolis, being the trial of a plate made in this country on a new system, that of Mr. H. A. Harvey of Newark, founded on the homogeneous steel of Schneider and adopting the admitted improvements of a nickel alloy, but using a new process of manufacture.

This process is that of decarbonizing the surface of the steel plate so as to give it a very high temper and extreme hardness, with a view to breaking up even the best projectiles. Taking a homogeneous plate of mild steel throughout, or of steel with nickel alloy, the front surface is treated by this process, with a gradual diminution of it in the interior, while the back of the plate remains untouched. The object in not continuing the hardening process throughout is to retain the toughness and tenacity of the mild steel at the back, so that if the projectile should break up the front, the tendency to crack all the way through will be avoided.

The Harvey plate in the present trials was manufactured by Carnegie, Phipps & Co., of Pittsburg. In a preliminary test of the Harvey process, made last February, a plate 10½ inches thick was fired at by a 6 inch gun. Six rounds were fired, half with Holtzer and half with Carpenter or Firminy projectiles. The Harvey plate was very severely cracked by the end of the trial, but the naval authorities had grounds to believe that for a single shot a plate made under this process might resist better than any other ever manufactured. In fact, this armor had shattered two of the Carpenter shells, which had penetrated less than half way, and one of the Holtzer, which did not get quite through. It was accordingly determined to try several other Harvey plates, to be made for experimental purposes by the Pittsburg firm.

In order to test thoroughly, not only the intrinsic strength of the Harvey plate, but its relative efficiency, it was further determined to try no fewer than five plates, two of which should be of homogeneous steel, one of steel with a nickel alloy, and two of the nickel steel manufactured by the decarbonizing Harvey process, all made at the Pittsburg works and each eight feet long by six feet wide, but with a thickness of only three inches. This latter represents the protective decks and shields of some of our war vessels, and is sufficient for illustrating the comparative merits of the systems of manufacture. Of course they could not be attacked by heavy guns, and a six-pounder Hotchkiss rapid-fire gun was substituted. The plates were arranged at a distance of about twelve yards from the gun, and twenty rounds were fired against each plate. The result was the complete destruction of the two steel plates and the penetration of the nickel steel as far as the oak backing, which was entered and injured. But the Harvey plates kept out the projectiles from the oak backing, and though they showed some cracks they completely broke up the projectiles and gained a great triumph.

Taken together with the February test of a thicker Harvey plate, this trial makes it clear that still another advance has been made by our naval ordnance bureau in the method of manufacturing armor. It has also practically confirmed the conclusions reached last September and in subsequent tests that an alloy of nickel yields better results than steel without the alloy.

Granite.

According to Census Bulletin No. 45, giving the totals for the United States, it appears that something over 62,000,000 cubic feet of granite, having a total value in round numbers of $14,500,000, were produced by 22,313 workmen from 874 quarries in 1889. To this number of men over $9,600,000 in wages were paid. The total expense of producing the entire granite output amounts to over $11,500,000, thus indicating a profit to the producers of about $3,000,000. The total capital invested is over $19,000,000, of which something more than one-half is the value of land. The great bulk of granite comes from the New England States. Its principal uses are as follows:

BUILDING PURPOSES.

Solid fronts.	Lintels.	Pilasters.
Foundations.	Broken range.	Belting or belt courses.
Cellar walls.	Sills.	Rubble.
Underpinning.	Kiln stone.	Range.
Steps.	Capping.	Ashlar.
Buttresses.	Columns.	Forts.
Window sills.	Plinths.	Dimension.

STREET WORK.

Paving blocks.	Road making—	Basin heads or catch-basin corners.
Belgian blocks.	(a) Macadam.	
Curbing.	(b) Telford.	Sledged stone.
Flagging.	(c) Concrete.	Crushed stone.
		Breaker dust.

CEMETERY, MONUMENTAL, AND DECORATIVE PURPOSES.

Statues.	Gravestone sockets.	Mausolcums.
Monuments (entire).	Grave markers.	Urns.
Monument bases.	Cemetery posts.	Wainscoting.
Monument dies.	Cemetery rails.	Dados.
Monument shafts.	Cemetery coping.	Fountains.

BRIDGE, DAM, AND RAILROAD WORK.

Culverts.	Buttresses.	Riprap.
Aqueducts.	Bridge covering.	Approaches.
Dams.	Capstone.	Towers.
Wharf stone.	Rails.	Bank stone.
Breakwater.	Ashlar.	Parapets.
Jetties.	Ballast.	Docks.
Piers.		

MISCELLANEOUS.

Millstones.	Posts.	Refuse stone.
Levelers—rollers.	Engine and mach. beds.	Block granite.
Grout.	Random.	Boundary stone.
Walls (fences).	Yard stock.	Horse blocks.
Watering troughs.		

BLASTING.

The Knox system of blasting rock is used with general satisfaction in many of the larger quarries. A round hole is first drilled to the required depth, and into this is driven a reamer, which produces V-shaped grooves at opposite sides to the entire depth of the hole. The charge is then inserted, and the tamping is done in the usual manner, except that instead of driving the tamping down upon the top of the charge, an air space or cushion is reserved between the charge of powder and the tamping, and as far above the charge as possible. The explosive has, therefore, the greatest possible chance for expansion before actually breaking the rock, the tamping being put down only to a sufficient depth to insure firmness of position. The result of this method is that the force of the explosive is directed in the line of the grooves, and no shattering of the rock occurs if it be solid, such as is common in ordinary blasting operations, and, as a consequence, quarrymen are enabled to get out stone of rectangular shape without waste or loss of valuable rock.

Very large blasts or mines are sometimes fired in quarrying granite. A shaft is sunk to the required depth, and from it drifts are run in various directions. These chambers, or drifts, are then charged with explosives and fired. In 1887, at Granite Bend, Missouri, stone enough was broken with one blast to supply the demands of a firm for fifty years. The shaft, which was 85 feet deep, had chambers running in several directions from the bottom, and was charged with 32,700 pounds of black powder.

The explosive used for breaking out dimension stone is black blasting powder.

Drills driven either by steam or compressed air are in use for making blast holes in all the principal quarries. The drill is connected with the piston, which is supported by a portable iron tripod, carrying the necessary appliances for regulating its movements. A flexible pipe conveys the motive power in the form of compressed air or steam.

Steam channeling machines, common in large marble and sandstone quarries, are used on granite by a few quarriers chiefly for making end cuts in stone of exceptional structure, but only to a limited extent, since the great hardness of granite renders the process very slow and expensive.

CUTTING, POLISHING, AND ORNAMENTING GRANITE.

Owing to the great obduracy of this stone, and the fact that the different minerals composing it vary greatly in hardness, the chief work of shaping it is still performed by hand, probably by much the same process that was used by Egyptian stonecutters more than three thousand years ago. Improvements and inventions have, however, been made from time to time in hand tools, and extensive machinery is now in use for producing certain forms and kinds of finish.

The most important improvements include the more extended adoption of lathes for turning and polishing columns, urns, etc., and new devices in power machinery for plain polishing. Greater economy and speed are now obtained by the general use of chilled iron globules and crushed steel as abrasive materials and of the pneumatic tool for the ornamentation of surfaces.

Granite for columns, balusters, round posts, and urns is now worked chiefly in lathes, which, for the heaviest work, are made large enough to handle blocks 25 feet long and 5 feet in diameter. Instead of being turned to the desired size by sharp cutting instruments, as in ordinary machines for turning wood and metal, granite is turned or ground away by the wedge-like action of rather thick steel disks, rotated by the pressure of the stone as it slowly turns in the lathe. The disks, which are six or eight inches in diameter, are set at quite an angle to the stone, and move with an automatic carriage along the lathe bed. Large lathes have four disks, two on each side, and a column may be reduced some two inches in diameter the whole length of the stone by one lateral movement of the carriages along the bed. The first lathes for turning granite cut only cylindrical or conical columns; but an improved form is so made that templets or patterns may be inserted to guide the carriages, and columns having any desired swell may be as readily turned. For fine grinding and polishing the granite is transferred to another lathe, where the only machinery used is to produce a simple turning or revolution of the stone against iron blocks carrying the necessary grinding or polishing materials.

Blocks are prepared for lathe work by being roughed out with a point, and by having holes chiseled in their squared ends for the reception of the lathe dog and centers. This principle of cutting granite by means of disks revolved by contact with the stone has been also applied to the dressing of plain surfaces, the stone worked upon being mounted upon a traveling carriage and made to pass under a series of disks mounted in a stationary upright frame.

Tracery and lettering for polished granite are usually first drawn upon paper, which is firmly pasted to the surface and the design chiseled through it to the requisite depth in the rock.

Statues, capitals, keystones, and, in general, all highly ornamental designs, are worked out with chisels from detail drawings or plaster casts. It is necessarily a slow process, owing to the hardness of the rock, and the cost of such work is consequently great. The MacCoy pneumatic tool, however, which has been recently patented and successfully applied to this purpose, gives promise of superseding much of the tediousness of the hand process. This instrument is connected to a flexible pipe, supplying the compressed air or steam by which it is driven, and works at a remarkably high rate of speed. It may be moved to any part of a surface, and works with a celerity unapproached by other means.

Large Steam Pipes Composed of Small Ones.

The immense steam pipes which are necessary for the large sized engines in use at the Ferranti stations are composed of numerous smaller pipes bunched together to give the required carrying capacities. This arrangement of the pipes was thought necessary on account of the numerous accidents which have lately occurred from the bursting of large steam pipes in various parts of the world. Just how this arrangement will be accepted by engineers remains to be seen. While there are several good points about this kind of steam pipe, there appear to be also several poor ones. The increased cost necessary for its construction and the larger amount of surface exposed for condensation would appear to be somewhat against its being commonly employed. Of the increased safety assured by its use, *The Stationary Engineer* thinks, there can be no doubt, but whether or not it can be called a commercial success is not so plainly evident. Those who have had experience with it appear to think it answers every requirement.

© 1891 SCIENTIFIC AMERICAN, INC.

Correspondence.

Bergmann's Blackboard Covering.

To the Editor of the Scientific American:

Being a teacher, I give you my experience in making a blackboard with velvety surface. It is as near perfection as can be. I have used it for years. Take equal parts by weight of Prussian blue powdered and of chrome green powdered; mix well. For liquid, use gilder's sizing (solution of shellac in alcohol), thinned with one-half of alcohol; mix with part of combined dry powder to the thickness of cream. Use large and stiff brush; cover quickly. In an hour's time give second coat. In a day or two smooth the surface with hair cloth.

P. S.—This covering will never look gray, as that with lamp black will. C. H. BERGMANN.

Principal of the German School, Charleston, S. C.

Illicit Opening of Letters.

To the Editor of the Scientific American:

Not a hundred miles from New York there is a little country village where the wife of the postmaster is generally credited with opening private letters temporarily abstracted from the mails. It is said that she steams the flap over a tea kettle, opens and reads the letter and seals it again with a lick. Her illicit knowledge of the contents of certain epistles gives color to the supposition. I would like to have some of your numerous inventors suggest some means by which when a letter has been opened in this way it will reveal the fact. Ink powder, when dusted on the lid, would leave, perhaps, when licked, a smear of black, and thus betray the process; or the flap of the letter might be wet with some salt of silver, which would stain the paper and the tongue that licked it. X.

[Your proper course is to address the Post Office Department at Washington, D. C. It will at once investigate the matter, and your connection with it need never be known. Various inventions have been made for the purpose you suggest, such as insoluble glues, etc.—ED.]

A Needed Invention.

To the Editor of the Scientific American:

Something simple and easier of application than the ordinary indicator for determining the mean pressure against a piston would, we think, find ready sale. This is suggested by the fact that many persons using steam engines would be glad to know how many horse powers they are getting from a given amount of fuel, or what it requires to drive one or a number of machines. The cost of an indicator, the trouble and expense of attaching it, or the inability to use it, puts it beyond the reach of those not expert in its use. You are often asked, "How is the horse power of an engine estimated?" The answer is simple, but the query comes back, "How am I to get the *mean effective* pressure?"

For the purpose that we propose the operator does not care to know the point of cut-off, or the initial and terminal pressures; all he wants is the average of these, and we think a simple instrument might be devised that would give this data alone. It should be easily attached, perhaps at one or the other of the cylinder cocks, and so constructed as to give the desired reading of pressure without a calculation being necessary. QUIRK.

Tree Culture as a Profitable Investment.

To the Editor of the Scientific American:

I have just read the article headed "Metal as a Substitute for Wood in Railroad Ties," in SCIENTIFIC AMERICAN of April 25. The destruction of timber in America long ago arrested my attention. Timber suitable for posts and railroad ties is rapidly disappearing from our forests. Forty years ago I was an officer on the leading railroad in Georgia. The common price of best ties then, delivered on line of road, was fifteen cents. I do not know what the price is now on the same road, but some time ago it was about double.

Mr. Walter Katte, engineer on the Hudson River road, in the article referred to, says: "In am led to believe that upon the basis of 55 cents for a wooden tie and $3 for a steel tie, and under the conditions of traffic and maintenance expenses existing on this line, the relative economy is from 8 to 12 per cent in favor of the metal system." How any railroad can be made to pay with such an enormous expense as these prices imply I cannot understand.

I have frequently advised *young* men who farm to plant a few acres of their best land in such trees as would make the most lasting posts. If I was a young man, I would plant a few acres in cedars and keep them closely trimmed, leaving only the top buds to grow, thus making the whole force of the roots go into the straight body. No timber makes a better post or cross tie than cedar. Then there are other trees which are nearly as good. Among these I would mention mulberry, yellow locust, and chestnut. If these trees were planted in good ground, alluvial soil for instance, and the land cultivated in field peas and vines left on the ground to rot, the trees would grow rapidly, and the peas gathered or allowed to be consumed by hogs, the cost of cultivation would be found in the value of the pea crop, to say nothing of the growth of trees. There are *oak* trees now growing in this town on what was considered poor land, which are now 18 inches in diameter, planted by myself about the beginning of the civil war.

Every farmer who is living within five miles of a railroad would find it a profitable investment for himself, or his children, to plant out a reasonable amount of land in such trees as would make good ties, paying such attention to the trees as would throw the sap into the *body* instead of limbs. Hoping that these suggestions may do some good, I have ventured to communicate the thought to your paper. Having passed three score and ten years, I shall not live to see the result of my suggestion, if adopted, yet I believe great good will accrue to future generations.

WILLIAMS RUTHERFORD.

Athens, Ga.

Copying Book Illustrations and Other Similar Subjects by Means of Artificial Light.

Although, undoubtedly, the most important part in the operation of photographing such subjects as china, silver plate, glass vessels, coins, etc., is the employment of a proper method of lighting the objects—for owing to the great dissimilarity in the shapes of such articles, hardly any two objects being alike, or fail to be treated in precisely the same manner—still of almost equal importance is the preparation or preliminary treatment of many such articles preparatory to their being copied; and here we have a very wide field for the operator to exercise his ingenuity in.

In the case of such articles as glass jugs, tumblers, or decanters, where the main object is not only to show off the beauty of shape, but likewise to depict in many instances the exquisite designs cut upon their surfaces, it stands to reason that were any one to proceed and merely photograph the same straight away, without having recourse to some method of preventing the designs on the further planes of the glass articles from interfering with that on the immediate side next the lens, nothing but a confusion of the various designs would ensue by the one overlapping or interfering with the other. Hence one of the first steps to be taken is to so arrange the vessel as to prevent this. And in cases where the shape of the article is such as to permit of its being filled with a liquid, perhaps there is no better plan than that of filling it up with some semi-opaque liquid, which acts virtually as a backing or background to sides of the vessel. In the selection of such liquids a proper discrimination should be shown in the choice only of such liquids as are in keeping with the nature and shape of the various articles being photographed. It will require but little thought for an intelligent worker to understand that what would be quite suitable in the case of such an article as a cream jug would be quite out of place in the case of a wine decanter. Hence the necessity of selecting only such liquids as are in keeping with the articles being copied. There are, however, numerous fluids to choose from. Skim milk, in some cases, comes in very handy, so also does claret, port, and sherry wine in others, and an intelligent worker will, doubtless, be able to think of many more quite as suitable, such as beer and stout.

When following out this plan, it will be found that more natural results are secured when the vessels are not filled right up to the top.

So much for glass vessels. Now let me refer to the copying of silver cups and plate. In this class of work the main thing to overcome is the bright reflections of the burnished portions of the objects. Some writers advocate the use of ice when such is practicable, others recommend that the burnished parts receive an application of putty to deaden the surface and prevent the objectionable flare spots. I have used both these expedients with success, but latterly have discarded the use of them for a much simpler method. Simpler because it does not necessitate any tampering with the objects being copied, and, in cases where such are of a very delicate order, this becomes an important item, for with putty there is always a fear of damaging the surfaces.

The plan I adopt is merely to keep breathing on the object. This requires to be renewed after every few seconds during or at intervals in the exposure, but the cap of the lens can be easily put on and off to permit of the breathing being applied.

With some commercial firms, when any important object is being manufactured, and it is desired to have the same photographed, it is generally arranged for such being accomplished previously to the burnishing of the parts. This is a great advantage, but, of course, is not feasible in the great majority of cases.

When developing silver objects, the amount of pyro used should be very small, and the exposure given a very full one, and I have always got the best results on a dark background.

Medals and coins require some consideration in the selection of suitable backgrounds also, and the mode of their being held *in situ*. My best results with bronze medals and coins are got by using as a background a sheet of opal glass, and by placing the medals right on the surface with the aid of a very thick solution of powdered gum, almost to a jelly. Silver medals are best fixed up in the same way against a sheet of ordinary plain glass, while at some distance behind is placed a black velvet background. Gold medals and coins are best on opal, because they get more relief. China plates, and such like, are best relieved by black velvet placed at a distance.

So much for the necessary arrangements as to suitable backgrounds. When the best results are to be obtained, attention must be given to this point.

In lighting, there are numerous points to be considered, and here, at the outset, the first thing to be thought of is the shape of the object being photographed. When using artificial light, I know of no better place for an amateur, or professional either for that matter, to use than his long dining room table placed under his gasalier. From such he may with convenience lead the gas to his Argand burners on their pedestals on the table by means of the rubber tubing, and when it is deemed expedient to throw in as much top light as possible, the gasalier, when fully lit, will render good help in this respect. Some objects are best lit by reflected light alone. In my practice I use my own invention, which is a plaster of Paris chamber when copying some classes of subjects, but a very good and simple makeshift can be rigged up by any one without any great cost. Say it is desired to copy a china plate so as to show off the design. Now here we have just a case in point that is best done by reflected light. This I would put into my chamber and so arrange matters that the lights are not in front of the object, but that the strong, bottled-up light brilliantly surrounded it.

A similar mode of lighting can be arranged for by merely cutting out a center in a large mounting board. This aperture should only be large enough to permit of the lens viewing the plate through. The china plate is then placed in position, and the two Argand lamps, one at each side, but not in front, so as to throw only reflected light upon the white cardboard on it. In very many cases, when photographing by artificial light, it will be found that this intervening screen, placed so as to reflect light only on the object, will give much better results than by throwing the light directly from the gas lamps in front. One great advantage is that reflections are not nearly so liable to arise, and if the brass fittings of the camera and lens are covered up with a black cloth, there should be no reflections at all to contend with.—*T. N. Armstrong, British Journal of Photography.*

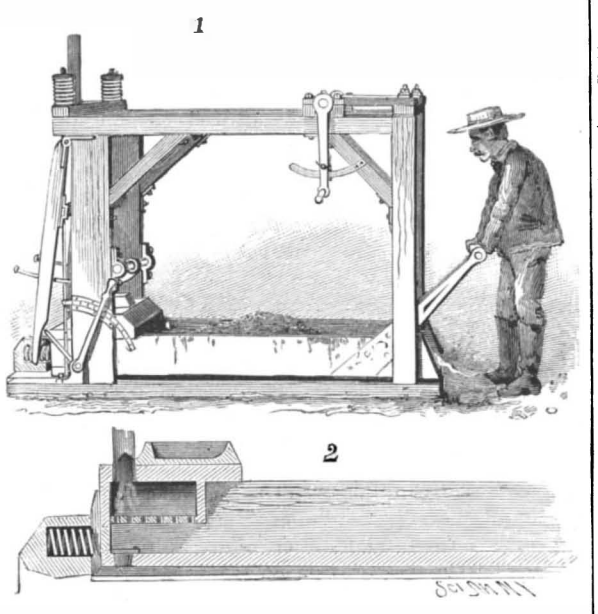
Recent Discoveries of Egyptian Remains.

Writing to the New York *Nation* from Keneh, Upper Egypt, on March 17, Mr. W. H. Goodyear describes an important and most interesting discovery made by Mr. Petrie at Maydoom. Mr. Petrie has there unearthed "the oldest known Egyptian temple and the only Pyramid temple ever found." Apart from the "Temple of the Sphinx" at Ghizeh, this building is also "the only temple of the Old Empire so far known." It was buried under about forty feet of rubbish. It lies directly at the center of the eastern base of the Pyramid, on the side facing which it has two round-topped obelisks. "Obelisks and temple chambers so far entered," says Mr. Goodyear, "have the plain undecorated style of the Old Empire, as shown by the Temple of the Sphinx, but hieratic inscriptions in black paint found within fix the name of Seneferoo as builder, and confirm the supposition to this effect hitherto based on the fact that tombs near the Pyramid contain his cartouche. Seneferoo is the king connecting the third and fourth dynasties, and variously placed in either. According to computations of Mariette and Brugsch, the antiquity will be about 4000 B. C., or earlier." On Tuesday, March 10, Mr. Petrie's workmen reached a platform which appeared to be a causeway terminating with two obelisks at the base of the Pyramid. "In the forenoon of Wednesday," continues Mr. Goodyear, "a workman came to say that an opening had been found under the platform on the side next the Pyramid. This proved to be the top of a doorway choked by detritus, through which Mr. Petrie crawled into an interior of three chambers and discovered the inscriptions mentioned. I had the pleasure of following him. Mr. Petrie thought the apartments had not been previously entered for about three thousand years—that is to say, that the rubbish fallen from the Pyramid had choked the entrance about three thousand years after construction. A friend who was with me noticed on the floor some dried wisps of papyrus, a plant now extinct in Egypt. The chambers thus far found are so filled that one cannot stand erect in them, and a door at the end of the third chamber is blocked by large stones. Over all lies an enormous mass of detritus, whose removal by Arab diggers is now in progress. I had the pleasure next day of carrying the news of Mr. Petrie's find to the gentlemen of the Egypt Exploration Fund, at Beni-Hassan, and of witnessing their unaffected delight over it."

© 1891 SCIENTIFIC AMERICAN, INC.

AN IMPROVED ORE WASHER.

A machine designed to facilitate the cleansing and separation of ores is shown in the accompanying illustration, and has been patented by Mr. Frederick C. Miller, of No. 136 East Tenth Street, Leadville, Col. A box-like washing table is suspended in a suitable frame, by two pairs of perpendicular rods, one pair at each end of the frame. The table is normally held very nearly level, its upper end, where the water box is located, being only about two inches above the other end, while the height of the lower or tail end, at which are the handles for working the machine by hand, as shown in Fig. 1, may be adjusted as desired. This is effected by attaching the suspension rods at this end to the outwardly extending arms of a crank on a rock-shaft journaled in the top of the frame, a rack being provided to hold the lever in adjusted position. The suspension rods at the head end of the table have coiled springs around their upper extremities, to impart to the table as it is operated a quivering motion. The base of the frame, at this end, has a buffer block, in a recess in which is a coiled spring. The water box, connected with a water supply tube, has a perforated bottom, as shown in Fig. 2, and beneath the water box, at the upper end of the table, is a series of valved openings, to be closed by plugs or otherwise. When the ore has been sufficiently washed, it is permitted to pass through these openings beneath a spray of water. Upon a cover plate of the table, over the water box, is a rectangular recess or coping, one side of which is adapted to be engaged by a curved arm, or cam shaft, integral with a drive shaft, when the machine is operated by power. The other side of this recess is engaged by the lower end of a spring arm, engaged by levers, actuated by crank arms integral with a shaft journaled in the base of the frame. An upwardly extending arm from one end of the shaft engages a rack at one side of the frame, whereby the tension of the spring arm may be increased or diminished. As the table is oscillated, either by hand or power, the motion and the reaction of the spring at the upper end tend to throw the heavy particles of ore in that direction, while the light or waste particles are carried out by the water at the lower end.



MILLER'S ORE WASHER.

BREAST WHEEL FOR LIFTING WATER INTO THE MORRIS CANAL.

The accompanying illustrations show the machinery used for supplying one of the summit levels of Morris Canal with water. The canal, coming from the coal region of Pennsylvania, passes through the city of Newark, N. J., across the salt meadows known as the Jersey flats, and into the Hackensack River at the point where the Passaic River joins it and opens out into Newark Bay. One portion of the canal terminates at this point. The boats going on to Jersey City are hauled directly across the river. The mules, generally used for towing on the canal, walk across the regular bridge, drawing the boat after them across the river. When there is an incoming tide the boats would be swept up against the bridge. To prevent this an iron cable is carried across the river, and to this, when necessary, the boats are attached by a traveling pulley, so that the cable keeps them away from the bridge. When the tide is running out, the cable is not used.

After crossing the river, there intervenes between the eastern shore of Newark Bay and Jersey City the Bayonne and Bergen Point peninsula, which is two or three miles wide at this point. By pursuing a somewhat devious route, the canal crosses this peninsula with one level, of eight miles in length, the water of which is about four feet above high water in the New York or Newark Bays. At the east and west ends of this level there are two locks, a single one at each extremity, which lock the boats up from, or down to, tide water, as the case may require. The machinery we show is designed to supply this level with water.

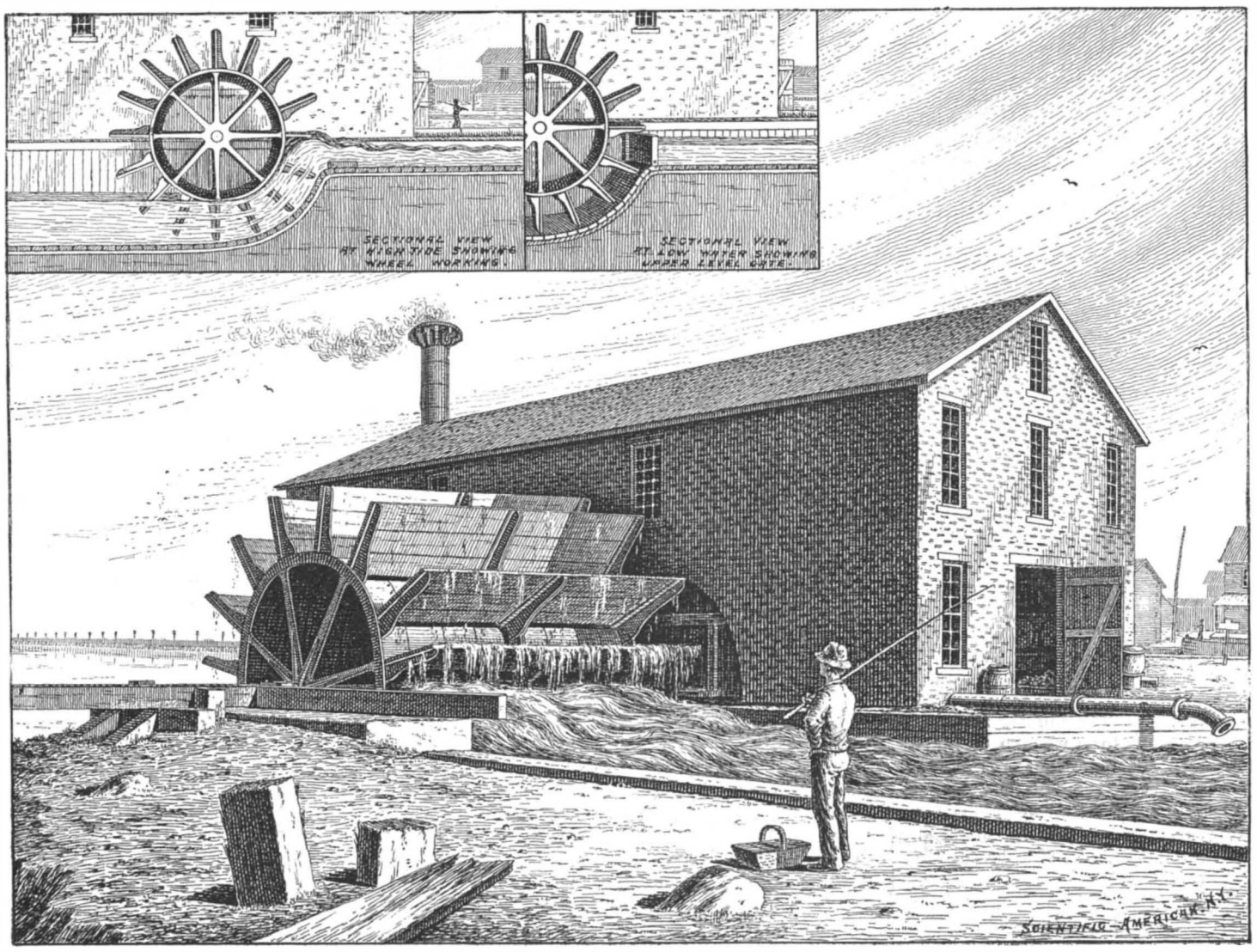
The water-raising mechanism consists essentially of a breast wheel, working in a masonry flume or breast, an inch or two of space only intervening between the floats and stonework. The wheel is 12 feet long, and carries a 10 foot sheet iron drum. The whole works upon a 10 inch iron shaft. From the periphery of the drum the buckets project. These are 3 feet 6 inches in width and 12 feet long, corresponding with the drum. The shaft carries a large cog wheel on its inner end; a spur wheel gears into this, the ratio of the diameters being such that the breast wheel makes one revolution for four revolutions of the spur wheel. It is obvious that if the wheel is rotated, it will raise water and deliver it into the canal, provided the rotation is in the proper direction, which is, of course, the reverse of that it would receive were it a motor wheel.

Directly in front of it is a gate pivoted at the bottom, which acts as a valve. As long as the wheel is in action throwing water into the canal, this gate lies flat upon the floor of the flume. When the wheel is stopped the gate rises as the water tends to flow backward, and closes the flume, thereby impounding the water in the canal. The wheel is so situated as regards level that it can work from the time when the tide is half flood until it is full flood, and until it falls to half ebb; thus in practice it is worked seven hours each day, when the tide is rising and falling, catching the last of the flood and the first of the ebb. It is situated on the banks of Newark Bay, and takes water directly therefrom. It is driven by a low pressure beam engine, with a 36 inch cylinder and 6 foot stroke.

The engine shaft, to which the spur wheel already referred to is attached, carries also a 15 foot fly wheel. The coal consumed amounts to 1½ tons per day.

In seven hours' pumping it raises the water in the eight mile level sufficient to compensate for the loss during the rest of the day. It can raise the level one inch an hour. As the canal is from 35 to 40 feet wide, this gives an approximate basis on which to estimate the delivery of water.

The apparatus was erected in 1859, and is to a certain extent an interesting example of old engineering practice. An effort was made to substitute for this wheel a rotary pump with 12 inch connections, but it did not prove successful. The pump and connections are still there to act as a reserve in case the wheel should break down. The drum of the wheel is quite essential to its strength; on one occasion when this broke down it was found that the wheel could not be used, as the floats were twisted out of place by the strain. By allowing the steam pressure to run down, the wheel can be made to operate like a breast wheel, so as to drive the engine backward. The only communication between the summit level and the tide water as far as regards the intake of water is by means of this wheel, yet it is found that it not only supplies the canal with water, but the crabs and fish are introduced with the water. During the crabbing season, the crustaceans are found in considerable quantities in the canal, being thrown into it by the water wheel.


SECTIONAL VIEW AT HIGH TIDE SHOWING WHEEL WORKING
SECTIONAL VIEW AT LOW WATER SHOWING UPPER LEVER GATE
SCIENTIFIC AMERICAN, N.Y.

BREAST WHEEL FOR LIFTING WATER INTO THE MORRIS CANAL.

THE class of buildings struck most frequently by lightning are, first, dwellings; second, barns and granaries. Oil-tanks and oil-works come next.

© 1891 SCIENTIFIC AMERICAN, INC.

SOME APPARATUS USED BY THE VIENNA FIRE DEPARTMENT.

A model fire department, which is well organized and under strict military discipline, is the pride of every large city, and Vienna is no exception to this rule. We publish herewith engravings of some of the apparatus employed by the Fire Department of that city. (For which we are indebted to *Ueber Land und Meer*.) According to the laws of the Fire Department of Vienna, not more than one minute must elapse between the sounding of the alarm and the start from the engine house. This promptness in responding to a call constitutes the great value of such a department, for it is all important that the men and apparatus should be on the ground before the flames have gained much headway. In Vienna, as in other large cities, there is a central station, and, besides this, branch stations in all the different districts of the city. In many of the streets there are public alarm boxes which can be made to operate by pressing a button, and large public buildings have their private fire alarms. The telephone has been much used for this purpose of late, and watch is kept over a large part of the city from the towers of St. Stephen's Cathedral.

The Fire Department of each city has its characteristic features. In Vienna the approach of the engine is announced from afar by long-drawn blasts on a horn, and almost involuntarily the step of the passer is arrested, while all vehicles get out of the way as soon as possible. A few seconds later the engine rattles past, drawn by strong horses, which are driven at a rate of speed forbidden to all other vehicles on the streets. A slight investigation is usually sufficient to make the situation clear to the inspector, and a few seconds later powerful streams of water are thrown on the raging element.

The men fight bravely, and if a human life is in danger they unhesitatingly risk their own in their efforts to save it. With the modern buildings which are constantly climbing higher, the danger of the occupants from fire is greatly increased. If the staircase burns and the firemen see that the escape of those in the upper stories is cut off, they rescue them by means of an almost endless ladder which can be extended so as to reach to the highest windows. But sometimes it is too late to use the ladder, and the frightened people stand at the windows, imprisoned in their own dwelling by the fire. The flames have crept close behind them and their only means of escape is by jumping to the ground, where ten or twelve firemen have stretched a strong fabric which greatly lessens the force of the fall. Sometimes there is even greater danger (fortunately these cases are very rare) from a fire which has been discovered after the smoke has already stupefied the sleepers in their rooms; their rescue would be impossible were it not for the devices which have lately been adopted for emergencies of this kind and which are different from anything in use by our fire departments.

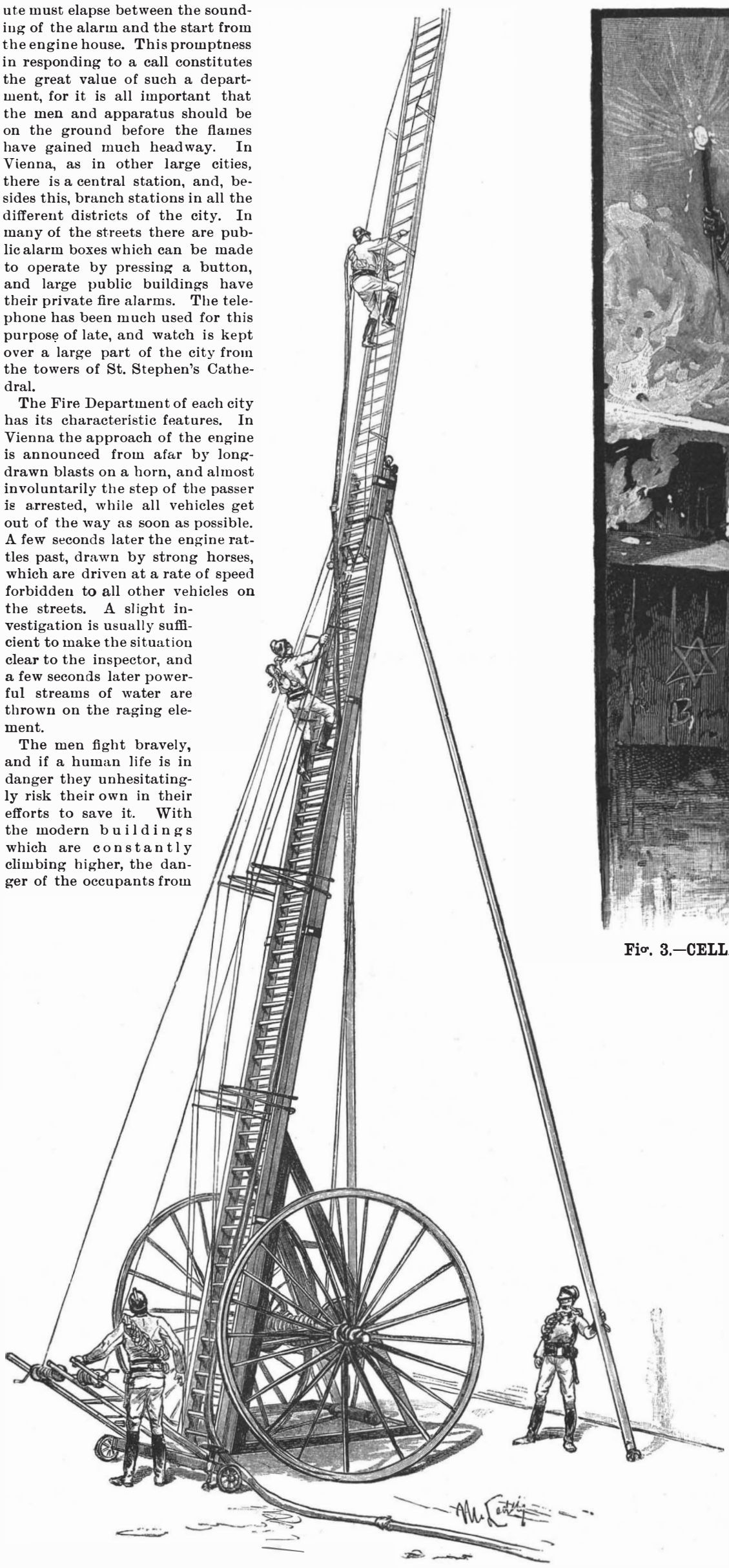


Fig. 1.—THE EXTENSION LADDER.

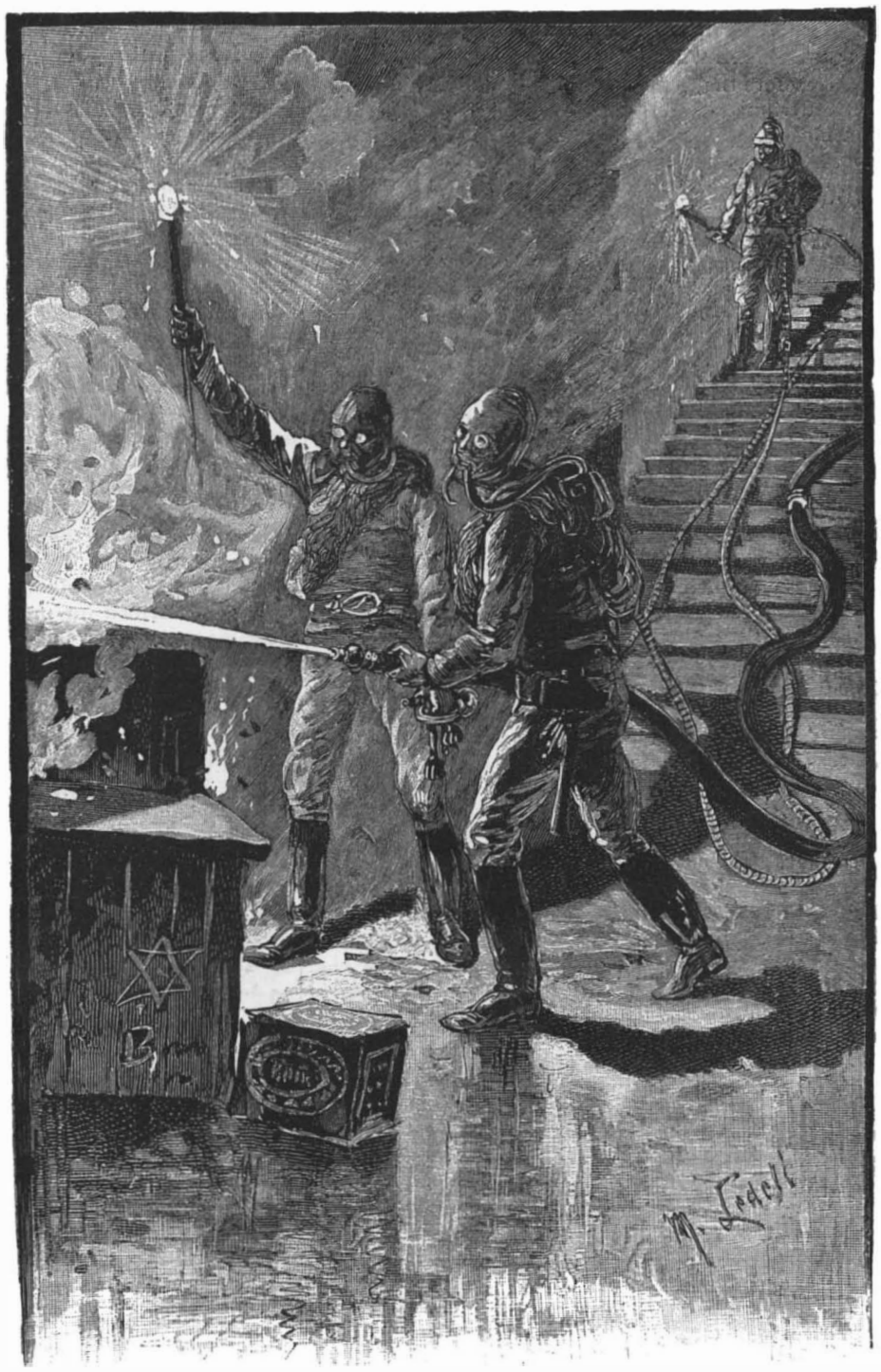


Fig. 3.—CELLAR FIRE—FIRE MASK AND ZINC FLAMBEAU.

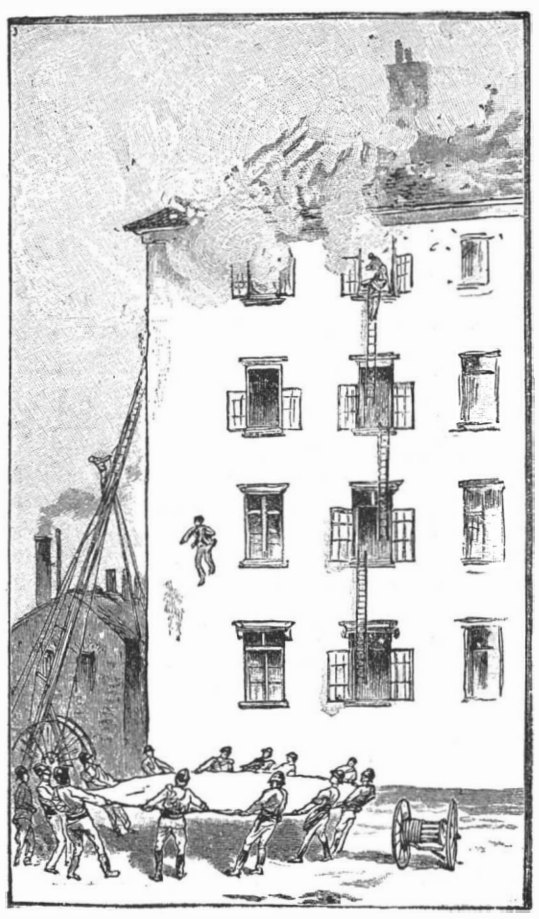


Fig. 2.—THE CANVAS.

© 1891 SCIENTIFIC AMERICAN, INC.

These consist of the so-called diver's suit and the fire mask, with which the fireman is able to make his way into a burning building in spite of steam and smoke, and sometimes to save those who have been given up as lost. The danger of suffocation is greatest where the fire occurs in the cellar, and in such cases even the firemen have to use the utmost caution. The smoke often collects in masses which would extinguish any ordinary light, but the zinc flambeau invented some time ago by Chief Inspector Stritzel works very well under these conditions.

THE TYPE-WRITER A FRENCH INVENTION.

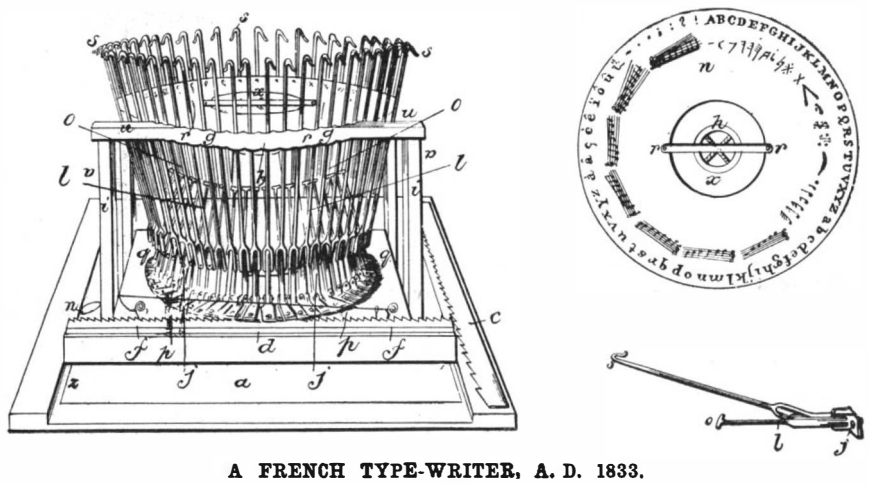
Heretofore the earliest invention of type-writers has been attributed to the English, and the first working machine showing the pot of letter levers striking at a common center was supposed to be of American origin. But the French appear to stand first in this respect. In 1833 a French patent was granted to Mons. Progrin (Xavier), of Marseilles, for a type-writer, which he called a Typographic machine or Pen. It is engraved and described in *Brevets d'Invention*, vol. 37, First Series, plate 36. We give an engraving of the drawings. All of the figures in the original patent drawings are probably not given, but we present all that are published. The description refers to a number of parts not represented in the published drawings, and hence the account of the machine is somewhat obscure. Still enough is given to show that the machine was an operative one, by which type-writing could be well executed.

Instead of having the paper rendered movable and the machine stationary, as in the modern style of machines, our French inventor held the paper fast and flat, and moved his machine over the surface of the paper. With this device he not only executed type-writing, but also wrote music and made printing plates. The following is an abstract from the inventor's specification:

This typographic machine or pen serves: 1. To print almost as rapidly as one can write with an ordinary pen. 2. To form stereotype plates for the use of ordinary presses. 3. To copy music or to form stereotype plates of music.

s are metallic levers which rise obliquely around the plate, *n*, and terminate in a fork at their lower end, which takes the shank of the hammer to raise or lower it at will. If one of these levers is pressed, it pushes the shank of the hammer over which its fork passes, causing it to be inclined like the radius of a circle.

When this shank is thus extended on the plate, the hammer remains in a vertical position on the paper, where in falling it has imprinted its figure; the number of levers is equal to that of the double alphabet and the rest of the characters of printing. Each lever corresponds to one of the signs drawn on the plate, *n*, so that, if it is desired to form any letter in the center of the opening, *k*, it is only necessary to find the letter on the plate, *n*, and press lightly on the lever near it, and immediately it will be seen formed on the paper in the center of the opening, *k*, then the plate, *q*, is moved the distance of one notch, a finger is placed on another lever, which is caused to descend and strike its hammer beside the other letter, where it imprints the letter which it carries; thus the same operations are repeated and words and lines of printing are formed. We have explained how it is necessary to push the plate, *q*, one notch for the space of the letter to be printed, and two notches after the letter has been formed to obtain the space for a capital letter or for the distance between two words; as the center of the opening, *k*, must necessarily follow, in a straight line, the movement of the plate, *q*, it should always trace a straight line of printing by means of all the characters which their hammers print successively thereon.



A FRENCH TYPE-WRITER, A. D. 1833.

OPERATION OF THE TYPOGRAPHIC MACHINE OR PEN FOR PRINTING.

After having placed the body of the machine at the entrance of the frame, *b*, so that the center of the plate, *q*, is beyond the upright of this frame, the letter which is to commence the word of the first line is sought on the plate, *n*, and then the lever which corresponds to this letter is pressed lightly with the right hand; this lever, in moving downward, imparts all its movements to its hammer, so that if it moves down, the hammer falls with force in the center of the opening, *k*, and there impresses, on the paper, the letter or sign which it bears; the lever is then promptly raised, and the hammer follows it, to give place to another, which, by the same operation, will impress its letter beside the first one, after care has been taken to push the body of the machine lightly with the left hand, provided that the springs, *f*, pass from one tooth to another of the notched plate, *d*. This movement, as we have said, marks the distance of the small letters, a double movement marks the distance of the capital letters or the space between two words.

When the first line of printing is finished, the strings, *y*, are pulled with the left hand, which removes the springs, *f*, a little from the plate, *d*, allowing the body, *v*, of the machine to slide back easily to the place for commencing a second line; but, in order to mark the distance between this line and the preceding one, the frame, *b*, must be pushed the distance of one notch, which frame supports the body of the machine; by this movement the center of the opening, *k*, is always found at the proper distance from the preceding line.

When a page has been printed, the frame, *b*, is made to slide back to the point indicated for the commencement of another page. This movement is facilitated by drawing lightly on the string, *n'*, which removes the spring, *e*, from the toothed plate, *c*. Each hammer, in moving down to the center of the opening, *k*, strikes against the pad, *h*, and is thus charged with ink. This pad can be removed when it has not sufficient ink. Then, before replacing it, it is rolled on a plate covered with a coating of ink. It is thus charged sufficiently to supply the hammers during the printing of two or three pages.

When the machine is to be used for forming stereotype plates, the hammers and half of their shanks are replaced by others which are considerably thicker; these latter hammers bear, in intaglio, the letters which are in relief on the others; then, in place of paper, you place on the frame, *a*, a plate of soft metal, which is 6 to 8 twelfths of an inch thick; it is cast in a mould which leaves one of its faces marked with furrows between two ridges; the furrows are of a width corresponding with the space between two lines of printing; on the projecting parts or ridges the hammers strike, leaving the imprint of the figures which they bear, in relief. The method of thus forming letters, words and lines in relief is the same as that which we have described for printing; that is, you look, in the same manner, on the plate, *n*, for the letter which you wish to form, and then you press lightly on the corresponding lever; and then the letter is immediately formed in relief on the metal. A stereotype plate can thus be formed very promptly, ready for use on ordinary presses; after it has been used for making the desired number of copies, it is again melted in its mould to be used in forming a new stereotype plate.

In order that the ktypographic machine or pen may be used for forming the signs or figures of music, the hammers with half of their shanks are removed. This half of the shank is replaced by another, longer or shorter. It is then given a hammer bearing, in intaglio or relief, one of the signs of music corresponding to a like sign which is drawn on the plate, *n*, opposite to the lever which holds and causes the movement of the said hammer. This difference in the lengths of the shanks of the hammers permits of forming the rising and descending gamuts, with the difference of notes and signs, without being obliged to push the body, *v*, of the machine up or down, to right or left; for only the same movement is made which is used in printing. When the notes formed on the end of each hammer are in relief, the machine is used for printing or copying music. When the same notes are intaglio, the machine is used for forming stereotype plates of music, by the method indicated for forming stereotype plates for printing.

With a little practice one can write as rapidly with the ktypographic pen as with the ordinary pen. I have called it ktypographic machine or pen because it prints by striking. It will give birth to a new art—that of ktypography. I invented this machine about a year ago.

Luxurious Trains.

The following description of the cars composing the Pullman new trans-continental train is taken from the New York *Sun:* The trains consist of vestibule drawing room and sleeping cars, an observation car, a dining car and a composite smoking car. The vestibule composite car is a magnificent affair, and is exclusively for men. A forward end is set apart for baggage. A compartment between the baggage room and the main saloon is fitted up as a barber shop and a bath room. Adjoining the bath room is a cafe. The rear section of the car is a smoking room. The vestibule sleeping cars, of which there are four on this train, are said by the managers of the Pullman company to be the best examples of their work ever turned out. They each contain twelve sections of two double berths and two drawing rooms. Movable incandescent lights are attached to each section, in order to allow one to lie in a berth and read. In one of these sleeping cars is a bath room for ladies. The dining car, besides containing ten tables, at which forty persons can dine at once, also contains a kitchen large enough to allow four cooks to work at once. An observation car will bring up the rear. The body is an open sitting room, finished in hard wood and furnished with upholstered rattan arm chairs and lounges. Among its conveniences are a writing desk, a large case of selected books, movable tables and an upright piano. But the main feature of the car, and the one which gives it its name, is the deep recess at the end of the car. The platform will accommodate about twenty persons. In the forward portion of this car will be a small office, which will be occupied by a stenographer and type-writer, whose duty it will be to write and mail the letters of any or all of the tourists gratis.

Inventors of Perpetual Motion Machines.

Some of the most ingenious and persistent men are laboring on the hopeless task of devising perpetual motion appliances. Our educational system is in many respects responsible for so much mental energy being wasted upon fallacies. If natural philosophy and elementary mechanics received the attention in common schools that their importance demands, there would be fewer persons pestering their friends to supply funds for the development of apparatus intended to cheat nature's laws. Ignorance of the laws of nature is, no doubt, responsible for the majority of perpetual motion devotees, yet some men who are well educated become pursuers of the chimera. It is frequently difficult to understand the mechanical fallacies that creep over what are otherwise bright intellects. Electricity seems to be deceiving many men and leading them into the belief that by means of this mysterious force more power can be received than what is given. Since the electric lighting and electric transmission of power era began, there has been a great increase in the applications to the Patent Office for protection of what are electrical perpetual motion machines. For years the Patent Office income was considerably augmented annually by the receipt of fees from inventors of perpetual motion machines, but no fees are now accepted from men working on that kind of apparatus. A printed circular is sent to applicants saying that nothing short of a working model would be received, and as the inventor never gets a model of this kind to work, he can do no more with the Patent Office. A correspondent of the St. Louis *Globe-Democrat* gives particulars of some curious recent perpetual motion cases. Mr. Keely has a good many imitators in a small way. A few months ago a New York lawyer went to Washington with parts of a machine, and had quite a controversy with the office because the patent was refused. He insisted that he had seen the machine in operation, that it was running day after day, and keeping a cider press going to boot. There was no deviating from the rule. The lawyer went back to New York, saying that he would produce the machine. He was not seen again until the centennial celebration lately, when he reminded the examiner of the case and told him how he had been fooled. At the time of making application the lawyer really believed that his client had discovered the long-sought principle. But when he got back to New York and told that the patent had been refused, the client confessed. The perpetual motion was no motion at all. Power was concealed in the cider press. It ran the press, and the press made the perpetual motion machine go too. The inventor had been charging 10 cents admission to see perpetual motion. He had fooled the public and his lawyer, and he hoped to slip through a claim.—*National Car and Locomotive Builder.*

The Care of Dynamos.

Place the oil catchers under the drip of the dynamo bearings, and never allow them to overflow on the floor.

Keep the floor of the dynamo room swept clean, so that no nails or other small pieces of metal can be drawn into the armature.

Never use or leave iron or steel tools near the machine, while at work, as these also are likely to be drawn into the armature if left too near it.

Oil cans made of copper or zinc are best for use about electrical apparatus.

Never allow oil to accumulate on the armature or shafts of the dynamo.

When the wires coming out of the shaft to the commutator become bare from cleaning, they should be recovered with kerite or okonite tape, or gum cloth, and shellacked, and allowed to dry for about eight or ten hours before being used.—*Practical Electricity.*

© 1891 SCIENTIFIC AMERICAN, INC.

Progress of Our Colored Population.

According to a recent census *Bulletin*, the race count has been made for the South Atlantic and South Central States, and for Missouri and Kansas, in advance of the main work of tabulation. The total population embraced in this count is 23,875,259, of which 16,868,205 were white, 6,996,166 colored, and 10,888 Chinese, Japanese, and Indians. In these States were found in 1890 fifteen-sixteenths of the entire colored population of the United States, so that for the purpose of immediately ascertaining the percentage of increase, the returns of these States are adequate and not likely to be materially affected by the returns of the other States and Territories, where the colored population is small.

The popular belief that the negroes were increasing at a much greater rate than the white population is erroneous.

During the past decade the colored race has not held its own against the white in a region where the climate and conditions are, of all those which the country affords, the best suited to its development. We give a table which shows the relative increase:

States.	Total population.	White.	Colored.	Per cent. 1890.	
	23,875,259	16,868,205	6,996,166	White.	Colored.
Alabama	1,513,017	830,796	681,431	54·91	45·04
Arkansas	1,128,179	816,517	311,227	72·37	27 59
Delaware	168,493	139,429	29,022	82·75	17·22
District of Columbia	230392	154,352	75,927	66·99	32·96
Florida	391,422	224,461	166,678	57·35	42·58
Georgia	1,837,353	973,462	863,716	52·98	47·01
Kansas	1,427,096	1,374,882	51,251	96·34	3·59
Kentucky	1,858,635	1,585,526	272,981	85·30	14·69
Louisiana	1,118,587	554,712	562,893	49·59	50·32
Maryland	1,042,390	824,149	218.004	79·06	20·92
Mississippi	1,289,600	539,703	747,720	41·85	57·98
Missouri	2,679,184	2,524,468	154,131	94·23	5·75
North Carolina	1 617,947	1,049,191	567,170	64·85	35·05
South Carolina	1,151,149	458,454	692,503	39·82	60·16
Tennessee	1,767.518	1,332,971	434,300	75·42	24·57
Texas	2,235,523	1,741,190	492,837	77·89	22·04
Virginia	1,655.980	1,014,680	640,867	61·27	38·70
West Virginia	762,794	729,262	33,508	95·61	4·39

Modification of the German Patent Law.

An amendment of the patent law of 1877 has been recently passed by the Reichstag, after having been read three times, and will come into force on the 1st of October next. The chief point to be noticed in the new law is that the examination of patents with regard to novelty is not to be abolished. The new law does not decide what amount of invention is patentable, so that this question must be settled in each case by the Patent Office as heretofore. Publication, if made more than a hundred years ago, is not to act in anticipation of a patent. Patents taken out in foreign countries are to act in anticipation against the inventor, and those claiming rights under him, only after a lapse of three months, and thus an extended period of time is allowed by the act for an application for a patent in Germany. If an invention is stolen from another person, and an application for a patent has been made, the inventor is able not only to oppose the granting of a patent to the applicant, but to obtain a patent for his own application. The patent fees may be paid for the whole duration of a patent in advance, so that the lapse of a patent through delay in the payment of fees may be rendered impossible. If a patent on which the full fees have been paid should be afterward annuled, the fees will be returned to the patentee. An application for the annuling of a patent shall not be made when the patent has been in existence more than five years. For the determination of this point, however, a period of three years is provided. The very high fees now payable for a German patent have not been diminished by the new act, but it is provided that such a lowering of the fees may be made by order of Federal Council. The important provision that a patent may be revoked after the expiration of three years if the patentee fails to carry out his invention in Germany to a suitable extent, or at least to do everything that he can to carry it out, remains in force, and should be particularly noticed by foreigners. The organization of the Patent Office is to be so regulated by the new act that there may be greater security for a proper and efficient examination of patents. Before an application is refused, the applicant is to have an opportunity of answering objections to the granting of a patent. If he should fail to obtain a patent, he may then support his claim by oral evidence. At the preliminary examination expert witnesses may be called, and a statement of the various attempts which the inventor had made may be presented. If the decision of a judge puts a new aspect on the case, the applicant is to have an opportunity of answering any objection raised. A proviso which is of great importance to chemical industries is that where proceedings are taken to patent a new material, every material of similar manufacture is regarded as included in the claim until proof to the contrary is shown. The damages payable for the infringement of a patent have been increased. The Patent Office, Berlin, was established at its new building in April last. This new office is in every respect suitable for its purpose, whereas the old one was too small. The public obtain a great advantage from the new arrangement, since the important technical library is now open to all persons from 9 A. M. to 9 P. M.

IRIDESCENT GLASS.

BY GEO. M. HOPKINS.

A visitor at the Metropolitan Museum of Art in this city cannot fail to notice in his tour of the galleries the exquisite ancient Cyprian glass ware, with its gorgeous iridescence surpassing in brilliancy of color anything ever produced by artificial means. So far as is at present known, this effect can be produced only by the corrosive action of the air and moisture of the soil in which these objects have been buried for centuries.

Glass having a similar appearance, but without the same brilliancy of color, has been found elsewhere, and a certain degree of iridescence has been imparted to glass of modern manufacture by flashing it during the annealing process with stannous chloride, thus depositing on the glass an exceedingly thin film, which decomposes the light and thus yields a pleasing color effect. Glassware of this kind is beautiful, and was at one time much in demand, but at present it can hardly be found on sale.

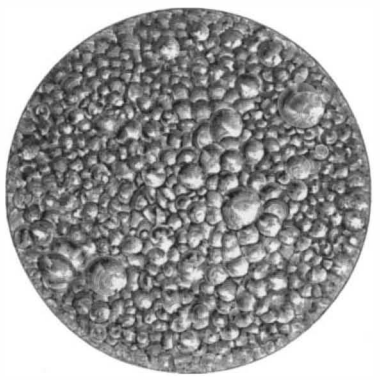


Fig. 1.—IRIDESCENT FILM—MAGNIFIED.

Through the courtesy of General L. P. Di Cesnola, director of the Metropolitan Museum of Art, the writer has been enabled to examine specimens of ancient Cyprian glass secured by him in his archæological explorations in Cyprus.

A microscopical examination of this glass shows that the surface is covered with exceedingly thin transparent films formed by matter dissolved from the glass. The body of the glass is pitted over its entire surface with minute cavities, which are circular or elliptical or oblong in outline, and either spherical, ellipsoidal, or cylindrical in respect to their concavity, and the films conform to the pitted surface of the glass. These films, of which there are many superposed, are so thin as to float in air like down when detached. They decompose the light by interference due to reflections from the front and rear surfaces of the film, and give rise to the gorgeous play of color for which these ancient specimens of glass are noted.

The appearance of the film from this glass when highly magnified is illustrated in Fig. 1. The color effect is, of course, wanting. By transmitted light the color is complementary to that shown by reflected light. Examined by polarized light, the color is heightened still more with all the changes that may be brought about by rotating the polarizer, analyzer, or the object itself. The figure under polarized light without the color is shown in Fig. 2.

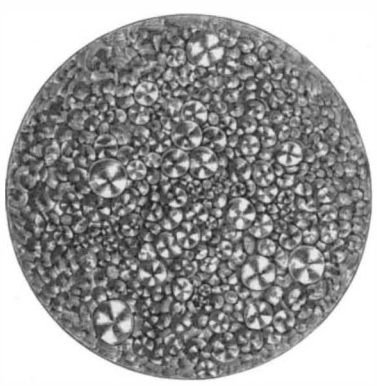


Fig. 2.—IRIDESCENT FILM—BY POLARIZED LIGHT.

If the effects secured by long ages of treatment in Nature's laboratory could be produced artificially on modern glass at a reasonable cost, it would seem to be an object well worth striving for.

Lumbering in California.

The Madera Flume and Trading Company started up its mountain saw mills recently. The roads are now being cleared and timber got out. It is expected that the output for the season will exceed 17,000,000 feet.

This company has a V-shaped flume sixty-two miles long, extending from the mountains to the plain. The lumber is not shipped down this flume piece by piece, but several planks are clamped together at the end, and then a train is formed from several piles and connected by small ropes. Section stations, where from two to four men are found, are located about every six miles. It is their duty to see that there are no stoppages or breakages, jams and so on. The lumber is shipped from the mountain mills during the day, and reaches the yards at Madera at night, being twelve hours in transit. The expense of this mode of transportation is much cheaper than any other that has been devised for that purpose. As high as 20,000 feet have been shipped in one day. The two saw mills are known as the California and Soquel mills, and combined have a sawing capacity of 150,000 feet per day. This work has been facilitated greatly by the construction of a narrow gauge railroad from the mill to the vicinity of the logging camps, and the logs are now hauled by a large engine, on cars made expressly for that purpose, thus doing away with many teams. At the yard located in Madera the lumber is taken from the flume and piled up to dry for the market. This yard covers a large area of ground, and millions of feet of lumber are stored there annually. A large planing mill is also operated there.

The expenses of the mill at Madera and at the mountain mills aggregate $15,000 per month during the logging season. Jack Dysdale is general superintendent of the mountain mills.—*Pacific Lumberman.*

Genesis of the Elements.

Professor William Crookes closes a most interesting address before the Institution of Electrical Engineers on the subject "Electricity in Transitu; from Plenum to Vacuum," with the following remarks on the genesis of the elements:

It is now generally acknowledged that there are several ranks in the elemental hierarchy, and that besides the well defined groups of chemical elements, there are underlying sub-groups. To these sub-groups has been given the name of "meta-elements." The original genesis of atoms assumes the action of two forms of energy working in time and space—one operating uniformly in accordance with a continuous fall of temperature, and the other having periodic cycles of ebb and swell, and intimately connected with the energy of electricity. The center of this creative force in its journey through space scattered seeds, or subatoms, that ultimately coalesced into the groupings known as chemical elements. At this genetic stage, the new-born particles vibrating in all directions and with all velocities, the faster-moving ones would still overtake the laggards, the slower would obstruct the quicker, and we should have groups formed in different parts of space. The constituents of each group whose form of energy governing atomic weight was not in accord with the mean rate of the bulk of the components of that group, would work to the outside and be thrown off to find other groups with which they were more in harmony. In time a condition of stability would be established, and we should have our present series of chemical elements, each with a definite atomic weight—definite on account of its being the average weight of an enormous number of subatoms, or meta-elements, each very near to the mean. The atomic weight of mercury, for instance, is called 200, but the atom of mercury as we know it is assumed to be made up of an enormous number of subatoms, each of which may vary slightly round the mean number 200 as a center.

We are sometimes asked why, if the elements have been evolved, we never see one of them transformed or in process of transformation into another. The question is as futile as the cavil that in the organic world we never see a horse metamorphosed into a cow. Before copper, *e. g.*, can be transmuted into gold it would have to be carried back to a simpler and more primitive state of matter, and then, so to speak, shunted on to the track which leads to gold.

This atomic scheme postulates a to and fro motion of a form of energy governing the electrical state of the atom. It is found that those elements generated as they approach the central position are electro-positive, and those on the retreat from this position are electro-negative. Moreover, the degree of positiveness or negativeness depends on the distance of the element from the central line; hence, calling the atom in the mean position electrically neutral, those subatoms which are on one side of the mean will be charged with positive electricity, and those on the other side of the mean position will be charged with negative electricity, the whole atom being neutral.

This is not a mere hypothesis, but may take the rank of a theory. It has been experimentally verified as far as possible with so baffling an enigma. Long-continued research in the laboratory has shown that in matter which has responded to every test of an element there are minute shades of difference which have admitted of selection and resolution into meta-elements, having exactly the properties required by theory. The earth yttria, which has been of such value in these electrical researches as a test of negatively excited atoms, is of no less interest in chemistry, having been the first body in which the existence of this sub-group of meta-elements was demonstrated.

© 1891 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

SPRING SEAT.—George E. McCormick and William B. McLean, Jamestown, North Dakota. This seat is designed for locomotive cabs, but is capable of other uses. It consists of two uprights connected by cross bars and provided with stops at their lower ends, side pieces pivoted to the uprights and engaging the stops, a flexible back and bottom secured to the uprights and side pieces, and springs projecting from the rear of the uprights and carrying a bar bearing on a support.

AUGER HANDLE. — Harry Naylor, Oil City, Pa. This handle is formed in two longitudinally adjustable sections provided with a grooved abutment and a loose rocking ring which clamps the bit shank against the abutment when the sections are forced toward each other, thus adapting the handle to clamp shanks of different sizes.

CAN VENTILATOR.—Albert W. Adams, Pittsburg, Pa. This device is designed for use on milk cans, to allow the animal matter in the milk to escape and prevent the milk from souring. For this purpose the can top has spaced apertures and is provided beneath the apertures with a shield having beveled ends and openings in said ends, the shield being of less diameter than the top.

STOVE.—John Werner, Brooklyn, N. Y. This stove contains a series of vertical pipes of different lengths, alternately arranged close together around its interior, thus forming the fire box. The pipes extend through the base at their lower ends and through the stove body at their upper ends, and support a grate above their lower ends. Substantially all the heat arising from the fuel may be utilized.

FOLDING POULTRY CRATE. — William Paschal, Rutherford, Tenn. This device is so constructed that it may be folded flat and compactly when not in use or in transportation, and when erected has no loose or unconnected parts. It is especially adapted for carrying poultry and other live stock. It affords free access of air and is light, strong and durable.

DESKS. — Mr. John M. Sauder, of Springfield, Ill., has patented an improved device for fastening desk tops and the backs and seat boards of school desks upon the supporting standards of the seat and desk. By means of this device the wooden desk top, the back, and the seat boards are interlocked with the metal standards or frames, securing an elastic connection between the wooden and metal parts of the desk, so that the expansion and contraction of the metal or the swelling and shrinking of the wood will be compensated for, so that cramping strains which would split the material or tend to loosen the frame will be avoided.

FABRIC STRETCHER. — Mr. Charles F. Flos, of Brooklyn, N. Y., has patented a frame for holding and stretching fabrics, which will suspend the fabric in proper position without injury to the material and without the assistance of cement or nails. The frame is also arranged to give to the fabric a suitable tension, so as to free it from wrinkles and creases. The sides of the stretcher are provided with beams having longitudinally extending gutters or shoulders to which is applied a clamp bar parallel with the beam, and adapted to press the fabric into engagement with the gutter or shoulder. Levers pivoted to the beams are employed for securing the required pressure.

HARNESS.—Mr. Lawson W. Hampton, of Elizabethton, Tenn., has recently patented an improvement in that class of harness in which traces and breeching are dispensed with and the attachment of the harness to the shafts of the vehicle is made by means of tugs connected with the girth and breast collar. The tugs are attached to a rod whose motion is opposed by a spiral spring. Harness of this construction permits of the free use of the hind legs of the horse, and diminishes the cost of a harness.

CUTTING AND PREPARING WOOD.—A novel method of cutting and preparing wood for ornamental and decorative purposes has been patented by Mr. Lewis W. Murch, of Medora, North Dakota. This method consists in cutting or sawing a log or limb having the bark thereon obliquely into blocks or boards. The blocks or boards thus cut form panel pieces which present a highly ornamental appearance, with the heart of the wood at the center, surrounded by the rings formed in the natural growth of the tree.

WAGON BOX. — An improvement in dumping wagon boxes has been patented by Mr. James M. Kimball, of Woodstock, Ill. This box may be carried on any ordinary running gear and may be used as a common wagon box. It is provided with means for dropping the load through the bottom, and for closing and locking the bottom leaves or boards after the load has been discharged. In the bottom of the box there is a cross beam and a center beam. Leaves hinged to the rear of the box and to the center beam form the bottom of the box. The box is provided with a series of catch levers and with releasing mechanism for withdrawing the catch levers, so as to allow the leaves to fall.

WASH BOARD. — John T. Lenoir, Columbia, Miss. The frame of this wash board is provided with a series of removable rectangular rubber bars having a rectangular slot for the greater part of their length; the bars consisting of two strips separated by spacing pieces at their ends, the spacing pieces having reduced, threaded extremities to pass through the side bars of the frame and receive lock nuts, the bars when in place resting at an incline one upon another.

FLY BRUSH.—Harvey Miller, Waterloo, Iowa. A circular casing is mounted to revolve on a door, the casing containing a volute spring which bears on a curved bar carrying a brush or brushes at its free outer end. By drawing on and releasing a cord wrapped around the casing, the latter and the brush are caused to revolve and drive away flies on and about the door.

PAINT.—George Walker, Jersey City, N. J. The ingredients of this paint are derived from the tar obtained by the destructive distillation of wood, preferably hard wood. The first product of distillation is a light oil and acid water, a portion of which is removed. The remainder is further distilled, leaving a residuum resembling asphaltum and solid when cold; this latter is dissolved in the light oil acid water, producing an intensely black paint.

CIGAR.—Samuel Heilbroner, New York City. This cigar has a lateral bend produced in its body, such bent portion being reduced in size, giving the cigar somewhat the shape of a pipe, so that in use a portion of the nicotine will be concentrated at the bend of the cigar and will drop with the ashes. A further advantage is that the cigar may be lighted without flame coming too close to the smoker's mouth or mustache.

TRUCK.—Joseph M. Sill, Towanda, Pa. This is a two-wheeled hand truck, especially adapted for use in warehouses for handling seed, grain, and flour in bags. The leg braces are arranged to serve as runners which may slide on the floor when the loaded truck is suddenly stopped, and the racks, legs, and leg braces are all flush with the side bars, so that the truck may be brought close to a platform, the construction being such that the cost will be but moderate, while the truck will be strong and will occupy but little space.

ANIMAL TRAP.—John Picard, St. Paul, Oregon. This is a trap for catching moles, gophers, etc., in which a vertical spear is forced down by a spring into the mole passage to impale the animal. The spear is held up by a trigger arm hinged or pivoted at its upper end, the arm extending down to a position to be deflected by the passage of the animal, so as to release the spear and allow it to descend. A trip plate connects the trigger to the spear rod, and the trigger is adjustable.

TYPEWRITING MACHINE. — David H. Taylor, Cincinnati, Ohio. This invention covers a novel construction and combination of parts in a typewriter in which capitals or lower case may be written by a single set of keys, avoiding the use of a capitalizing key. A double or two-part finger piece or key, the parts of which interlock for separate or simultaneous movement, is so arranged so that in writing lower case one part only will be depressed, but when it desired to write capitals both finger pieces will be depressed, the finger pieces being connected with different sets of key levers.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN
BUILDING EDITION.

MAY NUMBER.—(No. 67.)

TABLE OF CONTENTS.

1. Elegant plate in colors showing the residence of Henry Ivison, Esq., at Rutherford, N. J. One of the most picturesque and best appointed houses in the vicinity of New York. Also photographic perspective view, floor plans, etc.
2. Plate in colors showing the residence of Mr. George Comstock, of Bridgeport, Conn. One of the handsomest in Bridgeport. Photographic perspective view, floor plans, etc. Cost $10,000.
3. Design for a staircase of pleasing and novel appearance.
4. Photographic views and floor plans of a colonial cottage in Armour Villa Park, Bronxville, N. Y. Cost $2,800. W. W. Kent, architect, New York.
5. Engravings showing a perspective and floor plans of the residence of Mr. George Burnham, at Powelton Ave. Philadelphia, Pa.
6. Sketch of a drawing room.
7. A dwelling at New Haven, Conn. Cost complete $6,345. Perspective view, floor plans, etc.
8. Illustrations showing perspectives and ground plan of the First Presbyterian church, recently erected at Rutherford, N. J. Total cost complete $70,000. Messrs. Fowler & Hough, New York, architects.
9. A very attractive and picturesque cottage erected at Wayne, Pa. Cost $3,800 complete. Floor plans, perspective elevation, etc.
10. A cottage at Fanwood, N. J. Cost $4,200 complete. Photographic view, floor plans, etc.
11. Sketch showing the new "Empire Theater" of Philadelphia, Pa., designed to be one of the most commodious play houses in America. Architect Augus S. Wade.
12. Miscellaneous contents: Statuary marble.—John W. Root.—Ornament in architecture.—Steam pipe required for heating.—Painting ironwork.—Architectural foliage.—A luxurious bath.—Hardwood finish.—Decorations of the Hotel Metropole, London, England.—Oldest dwelling in the United States.—An improved gas engine, illustrated.—A sanitary laundry tub, illustrated.—Real estate investments.—American tin and terne plates.—An easily coupled door hanger, illustrated.—Architectural wood work, illustrated.—An improved scroll saw, illustrated.—Improved system of fireproofing, illustrated.—The new Bolton heater, illustrated.—The Sturtevant system of heating and ventilating school houses.—Finishing natural woods.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale—New and second hand lathes, planers, drills, shapers, engines, and boilers, belting, pulleys, and shafting. W. P. Davis, Rochester, N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Barrel, Keg and Hogshead Machinery. See adv., p. 189.

For best hoisting engine. J. S. Mundy, Newark, N. J.

Best Ice and Refrigerating Machines made by David Boyle, Chicago, Ill. 170 machines in satisfactory use.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

"How to Keep Boilers Clean." Send your address for free 96 p. book. Jas. C. Hotchkiss, 112 Liberty St., N. Y.

Billings' Double-acting Ratchet Drills, Drop Forgings, Bronze Forgings. Billings & Spencer Co., Hartford, Conn.

Wanted—A second-hand 9x14 or 10x12 automatic cut-off engine, Buckeye preferred. The Tanite Co., Stroudsburg, Pa.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Patent for sale, or will sell territorial rights. The McCandless truss, patented Sept. 16, 1890. For further information address W. D. Davis, Monticello, S. C.

For low prices on Iron Pipe, Valves, Gates, Fittings, Iron and Brass Castings, and Plumbers' Supplies, write A. & W. S. Carr Co., 138 and 140 Center St., New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

A rare opportunity for a young man with a few thousand dollars capital to secure a permanent position as manager of a Western water works company. Address President Water Co., care this paper.

Engineers, manufacturers, and makers are invited to send gratuitously catalogues, pricelists, and trade terms to George T. Poole, Assoc. R. I. B. A., Assoc. M. I. C. E., Colonial Architect and Superintendent of Public Works, Department of Public Works and Buildings, Perth, Western Australia.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3031) I. E. writes: I have a valuable autograph written with lead pencil. Is there any way to prevent it from fading, and preserve it? A. It will never fade. To preserve it from erasure pour skimmed milk over it, or apply the regular fixative sold in art stores. An artist could apply it for you.

(3032) B. H. asks: 1. Please inform me whether, and if so how, I can remove lithographing from tin lard pails. We have some lard pails which are lithographed, and this portion of the pail is varnished over the lithographing. Do you know of any way by which I can remove this lithographing by using acids? A. Boil in caustic soda solution. 2. Are chemicals ever used, and how, for bleaching lard? A. To a limited extent. Treatment with hot borax or soda solution may be adopted. The chemical treatment of lard is often in the line of adulteration.

(3033) W. S. N. asks: What two chemicals or acids will ignite and cause a flame when brought together? A. Phosphorus and iodine after a few seconds' contact; also pure chlorine gas and Dutch foil or powdered antimony, water and potassium; and several others.

(3034) F. H. McI. asks: How is aqua ammonia or concentrated ammonia made? Could I make it in small quantities for ice making, ammonia to be 24° to 26° strength? What kind of apparatus is needed to manufacture it in 500 pound lots? A. It is made by passing ammoniacal gas through water. A still for cooling the ammoniacal gas and an absorbing tank, the whole inclosed, is all that is necessary. The unabsorbed gas can be used to partially charge other water. It is better to purchase it ready made.

(3035) W. L. G. writes: "Matter," says Professor Thomson, according to your issue of May 2, "was considered indestructible." Please explain his meaning more fully. A. Matter is considered indestructible according to most authorities. Professor Thomson seems to be formulating the old doctrine that the atom or molecule is a center of forces. This is rather an intangible theory, although many have adopted it.

(3036) C. S. H. asks: 1. What advantage, if any, is there in green prints over blue? A. It is principally a matter of taste. 2. Will any cheap wine do for the experiments described in SUPPLEMENT, No. 808? A. No; use a mixture of alcohol and water in equal parts, colored with cochineal and a very little ammonia.

(3037) C. F. H. asks: What will take sulphuric acid out of a vegetable matter dissolved in the sulphuric acid? A. Treat with carbonate of barium and water, or carbonate of sodium.

(3038) C. F. V. D. writes: To drill a large hole through glass, use a piece of maple wood turned in the lathe to the desired size. Take a common bit and bore into the end of the wood to the depth of one quarter of an inch; insert the wood into a common bit brace and fasten a piece of board with a hole in it to turn the piece of wood. Place the hole over the spot to be drilled and apply coarse emery powder. A three-quarter or one inch hole can be bored in this manner in a very short time. I have found the wood superior to either iron or brass tubing for puncturing glass. The plate should be bored half way through upon one side, and the other half should be completed from the other side.

(3039) C. F. V. D. asks: 1. What kind of glass plates must I use in constructing a Wimshurst electrical induction machine, and how shall I test them for insulation? A. Use common window glass. Select sheets that are flat and free from wrinkles or bubbles. When the plates are completed, coat them with shellac varnish, and after they are apparently dry bake them in a warm oven, or allow them to remain near a stove or furnace for several hours. 2. What kind of glass jars to use in making Leyden jars, and how to test them for insulation? A. Use soda glass; if they retain the charge for a considerable time in dry weather in the winter, the insulation is perfect. If the charge escapes quickly, the insulation is defective. 3. What is the best flame to use (where gas is not economical) in doing such work as the so-called Bohemian glass blowers? A. Probably the best flame for your purpose is a gasolene blowpipe flame.

(3040) New Yorker in North China asks in regard to strain, power, and friction of 9 inch manila rope with 2 blocks of 4 sheaves each, etc. A. The breaking weight for a 9 inch manila rope is 21 tons. No more than 5 tons should be allowed under any circumstance as a working load, 3 tons being the proper working load. Your pair of 4 pulley blocks, with the rope fast at the top block, will be equal to a safe load of 24 tons. The last or hauling rope sustains a load of one-eighth of the suspended load when at rest, or for 24 tons weight the pull is 3 tons plus the friction. You are correct in regard to the division of the total strain by the number of sheaves, as also on the 6 sheave lift; 10 per cent is rather large for the large iron blocks with iron sheaves. The friction on each sheave is the same, and as there are 6 sheaves, each bearing the same weight and under the same conditions, should have, with a 10 per cent assigned friction, an amount due to the pull on any one rope multiplied by the six sheaves. As the final pull for the 1½ tons was 560 pounds, 10 per cent of which is 56×6=336 pounds friction, which added to 560 is 896 pounds for the total pull while the load is being lifted.

(3041) H. H. G.—For an air blast you will require an air compressor, which will give you any pressure required. The sand blast is driven from an air compressor. Steam or belt from any other power may be used. The amount of power depends upon the pressure and quantity of air wanted.

(3042) W. C. F.—If you desire to make a Siemens armature for your motor, you should follow the general directions given in SUPPLEMENT 600 for the armature.

(3043) W. W. H. asks: Can double-covered paraffined wire be used to wind field magnets? Is plaster of Paris porous enough to make good porous cups? A. Double-covered paraffined wire is too heavily insulated for use in the field or armature. Double-covered magnet wire is used for that purpose. Plaster of Paris porous cups are of little value.

(3044) J. J. F.—The most powerful guns of American and foreign make can carry from 9 to 12 miles.

(3045) J. R. M.—Use thin shellac varnish for brass work. Use French polish for taking out scratches on varnished furniture.

(3046) W. L. C. writes: In the SCIENTIFIC AMERICAN SUPPLEMENT of March 7, 1891, you give a formula for the paste used in Gassner dry battery. You say plaster 3 parts. Please inform me what is meant. Also give E. M. F. of such a battery. A. In the formula for Gassner battery the term "parts" means parts by weight. The E. M. F. of this battery is about 1⅓ volts.

(3047) W. H. N. asks for the recipe for paste that is used by the Eastern stereotypers on the roller moulding machines. A. To 1⅓ gallons of water add 2½ pounds of Peter Cooper's glue, allow to stand overnight, after which place it on the fire and cook slowly for two hours. Take ½ pound best English Paris white, and one pint of flour, packed tight in the measure, place them together in a basin and add sufficient water to make the mixture the consistency of buttermilk, add this to the glue when cooked as above and allow the whole to cook for one hour, when it will be ready for use. For another receipt see our SUPPLEMENT, No. 773.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(3048) URUSHIC ACID.—Will any one kindly tell me the constituents of this acid, which is the essential principle of japan lacquer (Urushi-yama)? I want to know what acids it most strongly resembles.—N. K. D., London.

[We hope that some of our readers will answer this query.—ED.]

(3049) F. W. H. asks: Can any kind of a sail boat, on the water, be made to go faster than the wind that drives the boat? The question is open for discussion by readers.

© 1891 SCIENTIFIC AMERICAN, INC.

NEW BOOKS AND PUBLICATIONS.

AN INTRODUCTION TO THE STUDY OF METALLURGY. By W. C. Roberts-Austen, C.B., F.R.S. London: Charles Griffin & Company. Philadelphia: J. B. Lippincott Company. 1891. Pp. xii, 292. Price $2.50.

The eminence of the author, his great ability as a writer, and the most interesting researches already developed by him in lectures remove this work from the necessity of a review. It is sufficient to say that its standard is as high as the rest of Dr. Austen's works, and that the subjects are treated from the same scientific standpoint that has so long characterized the author's lectures and publications. It contains numerous illustrations and tables when required to illustrate the subject. As was to be anticipated, the subject of alloys is treated at great length, especially as regards Chinese and Japanese compounds.

SURVEYING AND LEVELING INSTRUMENTS. By William Ford Stanley. London: E. & F. M. Spon, and the author. 1890. Pp. xi, 545. Price $3.

This work, written by a manufacturer of the instruments he describes, possesses considerable value from the very practical details of construction and full appreciation of features of instruments that can be expected from no one that is not equally conversant with their use and manufacture. It contains over three hundred illustrations and can be warmly commended to surveyors and civil engineers for their reading.

THE CORLISS ENGINE. By John T. Henthorn. Management of the Corliss Engine. By Charles D. Thurber. Edited by Egbert P. Watson & Son. New York. 1891. Pp. 92. Price $1.

These two papers, which are republished from the *Engineer*, of New York, are entirely practical in their character. It is stated that they are intended as a guide to the most economical management of the Corliss engine, and there is no doubt that they will be of use to the progressive engineer. The work is illustrated and contains a table of data, indicator diagrams, etc.

ARCHITECTURAL IRON AND STEEL. By William H. Birkmire. New York: John Wiley & Sons. 1891. Pp. xiv, 201. Price $3.50.

The title of this work describes its contents. It is devoted to the application of iron and steel in the construction of buildings, including the subject of specifications, ornamental work, and numerous tables of the properties of structural iron. It comprises also tables of squares, cubes, etc., such as required continually by the designer. It presents at the end the proposed New York building law, given as a useful example of legal limitations. It contains numerous illustrations, as required to illustrate its subject.

ODONTICS, OR THE THEORY AND PRACTICE OF THE TEETH OF GEARS. By George B. Grant. The Lexington Gear Works, Lexington, Mass. 1891. Pp. 103. Price $1.50.

This very practical work is made up of a series of contributions to the *American Machinist* for 1890. The subject seems to be excellently treated and contains numerous illustrations for skew, bevel, and the most complicated gears, as well as for simple, straight work.

PRACTICAL BLACKSMITHING. Compiled and edited by M. T. Richardson. Volume IV. New York: M. T. Richardson. 1891. Pp. 276. Price $1.

We are glad to see the fourth volume of this series, the preceding members of which have been reviewed in these columns. It is made up of a collection of articles by different skilled workmen. The present volume is devoted to "Jobs of Work," including tires, axle setting, springs, tool tempering, etc. A set of tables giving the sizes of iron and steel terminate the work.

HINTS TO POWER USERS. By Robert Grimshaw, M.E., etc. New York: Cassell Publishing Co. 1891. Pp. 160. Price $1.

The author considers that this book is for the practical man. It is, he states, free from high science, and is intended for the man who pays the bill. The very graphic and even humorous way in which the author possesses the art of presenting his views makes the little work interesting reading for every one.

LOOKING FORWARD FOR YOUNG MEN. Their interest and success. By Rev. George Sumner Weaver, D.D. Fowler & Wells Co. 1891. Pp. 218. Price $1.

The young man in this work is considered in the aspect of his patrimony, friends, politics, money and other practical factors in existence. The subject is popularly and well presented and should be a help to many in their struggles with the problems of life.

THE BIOGRAPHY OF DIO LEWIS, A.M., M.D. By Mary F. Eastman. New York: Fowler & Wells Co. 1891. Pp. 398.

This biography will undoubtedly be of interest to many readers of Dr. Lewis' popular medical works. It seems to be well put and graphically written, and will doubtless be warmly received by many readers.

SEASICKNESS: Cause, prevention, and cure. Voyaging for health. By Thomas Dutton, M.D. London: Bailliere, Tindall & Cox. (No date.) Pp. 79.

A work treating on seasickness as a serious trouble, and purporting to give what may at least be termed remedial measures therefore, should certainly command considerable attention. This work is devoted to this subject, treating also of the different voyages to be undertaken by invalids, and being written by one who has had considerable experience at sea as a ship's surgeon, and who is himself a victim to the malady of seasickness, possesses peculiar value.

TRAITE PRATIQUE DE PHOTOGRAPHIE, A L'USAGE DES AMATEURS ET DES DEBUTANTES. Par Charles Mendel. Paris: Librairie de la Science en Famille. 1890. Pp. 90. Illustrated.

LA VIE AU SEIN DES MERS. Par L. Dolls. Paris: J. B. Bailliere et Fils. 1891. Pp. 304.

The subject of deep sea life is here presented in a very popular manner with illustrations. The whole is produced in the neat and acceptable manner so characteristic of French publishers, and is a welcome addition to popular natural history.

INTERIOR WORLD. A romance, with an appendix, setting forth an original theory of gravitation. By Washington L. Tower. Oakland, Oregon: Milton H. Tower, publisher. 1885.

In this work the author develops several original theories and ideas of the writer, among others that of negative gravity, thus acting as a companion to Stockton's story based on the same idea.

URSULA. Honore de Balzac. Translated by Katharine Prescott Wormeley. Boston: Roberts Brothers. 1891. Pp. 358. Price $1.50.

This very elegant edition of Balzac is rapidly developing, Ursula being about the eighteenth volume of the series by the same translator. The translation seems a very good one, and the identification of the translator with the author must be by this time well nigh complete.

ZOOLOGICAL ARTICLES. Contributed to the "Encyclopædia Britannica." By E. Ray Lankester, M.A., LL.D., F.R.S. To which are added Kindred Articles. By W. Johnson Sollas, LL.D., F.R.S., Ludwig v. Graff, Ph.D., A. A. W. Hubrecht, Ph.D., LL.D., A. G. Bourne, D. Sc., W. A. Herdman, D. Sc. Edinburgh: Adam & Charles Black. New York: Charles Scribner's Sons. 1891. Pp. viii, 195. Price $5.

These reprints from the ninth edition of the Encyclopædia Britannica, profusely illustrated and on very heavy paper, make an exceedingly attractive series for the naturalist. Ten articles devoted to the lower forms of life constitute the work, thus bringing together matter scattered through many of the large volumes of the original work and forming a treatise of great value.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 12, 1891,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding machine, J. W. Wright 451,967
Air brake hose holder, S. M. Beery 452,334
Air compressor, E. Hill 452,132
Air compressor, hydraulic, W. R. Phillips 452,283
Amalgamator, J. W. Culmer 452,177
Ammonia absorber, F. Kaiser 452,273
Animal trap, J. Biasi 452,209
Anti-friction block, A. A. Youn 452,154
Axle collar, N. Harris 451,970
Back brace, W. T. Aaron 452,206
Bag holder, J. Davnie 452,216
Bags, coverting plain into bellows-folded satchel-bottom, E. E. Claussen 451,915
Bale box attachment, W. Sanders 452,287
Band cutter, J. P. Monnett 452,277
Barrel machine, Allgire & Williamson 452,330
Bating, Hull & Burns 452,271
Battery. See Galvanic battery. Primary battery. Secondary battery.
Bed bottom, Bird & Page 451,908
Bed, invalid, Johnson & Moore 452,304
Bedstead tablet, C. H. Murray 452,348
Beer barrels, pressure apparatus for, F. Ackermann 452,010
Beer, device for fermenting, J. F. Theurer 452,149
Bell striker, M. G. Crane 452,166
Belt, electric, C. D. Williams 452,250
Belt frame, conveyer, R. Oliver 452,191
Bicycle, J. H. Horah 451,972
Bicycle, Huelsen & Nagel 452,073
Bicycle, H. V. & W. H. Rhoades 452,195
Bicycle, N. Rowen 452,196
Billiard cue tip fastener, W. H. Jacoby 452,014
Billiard tables, game counter for, G. C. Bateman 451,993
Blind, Venetian, S. J. Fisher 451,924
Block. See Anti-friction block.
Board. See Embalming board. Game board. Ironing board. Rocking board.
Boiler furnace, steam, F. Trowbridge 451,961
Boiler furnaces, gas and smoke consumer for steam, G. A. Farwell 452,344
Boot, fabric, Beiger & Eberhart 452,158
Box. See Letter box. Mail box. Paper box. Shipping and storage box. Toll box.
Brace. See Back brace.
Brake. See Carriage brake.
Brake, D. Hull 452,272
Braking trains, E. E. Ries 452,041
Breakwater and beach, combined, W. L. Marshall 452,229
Bridgegate, J. C. Wallich 451,963
Brush holder, H. H. Blades 451,969
Brush, reservoir, C. Miller 451,974
Burial casket, G. Marqua 452,228
Burner. See Gas burner. Oil burner.
Butter lifter, J. B. Doolittle 452,044
Button, W. E. Jackson 452,045
Button fastener, T. R. Hyde, Jr 452,138
Button, hinged, P. Rodier 451,954
Cable grip, J. H. Masters 452,077, 452,078
Calk, driving, M. E. Reilly 452,284
Camera. See Photographic camera.
Cane splicing machine, G. A. Watkins 452,248
Car coupling, L. Gaddis 452,267
Car coupling, Roney & Lloyd 452,239
Car coupling, H. Ruppert 452,067
Car coupling, F. Wussow 452,000
Car, double deck water and feed stock, J. F. Butz 452,259
Car, electrically propelled, S. H. Short 451,980
Car for electric railways, motor, S. H. Short 452,035
Car heater, J. F. McElroy 452,349
Car motor, electric, J. Christiansen 452,176
Car motors, mounting for electric, S. H. Short 451,981
Car, passenger, Allen & Wellman 451,905
Car starter, J. T. Baird 451,906
Cars, automatic track sweeping and oiling attachment for street, R. H. Nesmith 452,279
Cars, driving mechanism for electric motor, S. H. Short 452,005
Cars, machinery for propelling electric, S. H. Short 452,036
Cars, power transmitting mechanism for, A. R. Cavner 451,913
Cars, safety grip brake for cable, C. E. Naylor 451,949
Cars, storage receptacle for, G. W. Turner 452,247
Carding machine, H. Dixon, Sr 451,920
Carpet fastener, S. D. Ridenour 452,286
Carriage brake, baby, A. V. Strait 452,087
Carriage jack and tire tightener, combined, J. J. Phare 452,235
Carving machine, S. F. Moore 452,144
Carving machine, T. L. Smith 452,322
Carving machines, feeding mechanism for, T. L. Smith 452,241
Case. See Cell case.
Cash indicating and recording apparatus, E. Schrabetz 452,170
Cash register and indicator, W. W. & W. H. Wythe 452,043
Casting apparatus, H. B. Cox 452,343
Cell case, H. Weis 452,115
Cellar drainer, W. Lee 452,308
Cement, marine F. C. Goodall 452,182
Cement or mortar mixer, F. S. Baldwin 451,992
Chain and gearing, sprocket, H. O. Kohler 452,122
Chair. See Convertible chair.
Chemicals, feeder for charging liquids with, A. J. West 452,172
Chopper. See Cotton chopper.
Churn, O. E. Bell 452,251
Cigar fillers, machine for breaking and making, B. Baron 452,011
Cigar fillers, method of and machine for making, B. Baron 452,012
Cigarmaker's gauge, Messina & Burgos 452,187
Clamp. See Pipe clamp. Wire clamp.
Clip. See Whiffletree clip.
Clock synchronizer, A. G. Wiseman 452,299
Closet cover, J. B. Bigelow 451,907
Cloth teseling machine, A. Brown 452,161
Clothes drier, McKinnan & Jameson 452,303
Clothes line pulley, J. J. Leuzinger 452,226
Clothes line reel, F. Meinzer 452,275
Clutch, A. E. Brown 452,162
Coin operated machine, W. H. Ashwell 452,068
Collar pad fastener, J. C. Mendenhall 452,079
Collar pad fastener, W. Williams 451,965
Comb, W. H. Bagshaw 452,156
Concentrating apparatus, R. D. Gates 451,926
Conductors, treating, J. B. Williams 452,091
Construction apparatus, P. & G. Keller 452,274
Convertible chair for children, A. Ostlund 452,168
Cork securer, E. E. Thorpe 452,089
Cornstalks, straw, and roots, machine for cutting, Curtiss & Middleton 452,262
Cotton chopper, N. J. Baggett 452,093
Cotton chopper and cultivator, combined, I. W. Gregg 452,183
Coupling. See Car coupling. Electric wire coupling. Thill coupling.
Coupling and cut-out, combined, J. D. F. Andrews 452,173
Crayons, etc., machine for making, Quinn, Jr., & Moulton 452,350
Cue tip shaper and chalk holder, J. W. Klapperich 451,938
Cuff holder, A. Hunter 452,137
Curtain fixture, P. Pfeil 452,282
Cut-out, thermal, G. H. Whittingham 452,152
Cutter. See Band cutter. Moulding cutter. Veneer.
Cutting and polishing tools, feeding up device for, A. Snow, Jr 452,293
Cutting apparatus, S. M. Carter 452,212
Cylinder lubricator, O. W. Griffiths 451,928
Daily reminder, C. E. Blodgett 451,910
Deflector, M. C. Pierce 452,081
Dental matrix, C. A. Meister 452,231
Depurator, J. W. Haughawout 452,131
Detachable handle for vessels, J. Kendrick 452,121
Dials, apparatus for enameling, F. W. Wetherbee 452,150
Display stand, F. W. Lowe 452,107
Door manipulator, F. Schmitz 452,084
Draught attachment for vehicles, spring, H. Barber 451,968
Drain pipe for buildings, J. L. Crittendon 452,023
Dress fitting apparatus, C. Shane 451,979
Drier. See Clothes drier.
Drilling, boring, or shaping machine, Tyler & De Vesian 452,169
Drilling machine, multiple, F. H. Richards 452,053
Dye, orange yellow, J. Schmid 452,197
Dyeing and bleaching yarn, machine for, Mason & Whitehead 452,040
Dyeing aniline black, H. Thies 452,324
Dyeing with gallacetophenone, R. Bohn 452,210
Earthenware articles, apparatus for moulding, Taylor & Brooke 452,202
Electric cable, W. A. Conner ..... 452,340 to 452,342
Electric connections, fusible cut out for, W. E. Dow 451,997
Electric meter, H. W. Miller 451,276
Electric meter, D. J. Chisholm 452,214
Electric reciprocating engine, C. J. Van Depoele 452,296
Electric wire conduit, T. T. La Point *et al* 451,941
Electric wire coupling, A. M. Hunt 451,933
Electric wire suspender, C. A. Lieb 452,017
Electrical conductors with lead, machine for covering, L. W. Tracy 451,960
Elevator safety catch, J. W. Byram 452,096
Embalming board, W. N. Clark 452,070
Embossing and printing press, C. A. Lieb 452,016
Embossing or ornamenting wood, paper, etc., machine for, Staber & Abbey 451,983
End gate, N. A. Cruzan 451,916
Engine. See Steam engine.
Envelope machine, A. D. Tyrrel 452,325
Extractor. See Juice extractor. Stump extractor.
Eye shade and head shield, combined, J. Ahlstrom 452,155
Eyeglasses, Fox & Brown 452,351
Eyelet setting machine, T. R. Hyde, Jr 452,139
Fare register for vehicles, R. De Sainte-Marie 452,123
Faucet plug, W. W. Moore 452,189
Faucet, stop, or valve, W. W. Moore 452,188
Feed water heater, W. W. Wells 452,049
Fence, J. C. Kremer 451,940
Fences, etc., constructing barb wire, E. B. Guenzel 452,002
Fertilizer distributer, J. W. Rozar 452,240
Filigree ornaments, making, C. K. Smith 452,292
Fire alarm and other purposes, visual indicator for, Crane & Cole 452,165
Fire escape, Koch & Adenauer 451,939
Fire escape, L. T. Nichols 452,280
Flood gate, automatic, J. C. Rodgers 451,953
Forge furnace, J. H. Sternbergh 452,007
Frame. See Belt frame.
Fruit picker, A. Fogeli 452,102
Fulling mill, D. J. Kenary 452,058
Furnace. See Boiler furnace. Forge furnace. Glass finishing furnace. Hot air furnace. Portable furnace.
Furniture, convertible, E. E. Sell 452,171
Gauge. See Cigar maker's gauge. Printing press feed gauge.
Galvanic battery, G. C. McCullough 451,948
Game and advertising device, F. Sanderson 451,956
Game apparatus, J. Prendergast 452,194
Game board, T. Hill 452,133
Game board, A. P. Pichereau 452,061
Gas, apparatus for the manufacture of hydrogen, J. W. Tallmadge 452,246
Gas burner, self-closing, C. H. Keeney 452,140
Gas engine attachment, M. M. Barrett 452,174
Gas machines or plants, pump for, A. T. Welch 452,116
Gas producer, E. Brook 452,256
Gate. See Bridge gate. End gate. Flood gate. Railway gate.
Gearing, driving ring for frictional, F. H. Underwood 451,985
Gearing, frictional, F. H. Underwood 451,986, 451,987
Geographical globe, A. L. Silvernail 452,291
Glass finishing furnace, H. C. Wood 452,205
Glass, machine for printing on, C. Z. F. Rott 451,978
Glue, machine for cutting and spreading, Keller & Conly 452,075
Grain binder, J. P. Bullock 452,337
Grain binders, tripping mechanism for, O. O. Storle 451,957
Grain drill shoe, J. M. Szarkowski 452,245
Grater, Kramer & Eriksson 452,015
Grinding machine, rotary, W. J. McGehe 452,004
Gun, breech loading, R. T. Torkelson 452,126
Gun, magazine, H. A. Pitcher 452,192
Hair curler, W. H. Sweeny 451,984
Hair pin, W. F. Young 452,005
Handle. See Detachable handle.
Handle fastening, L. Frank 452,218
Harness, back band for, W. M. Dunston 452,100
Harvester, J. Macphail 451,943
Harvester, corn, O. King *et al* 452,104
Harvester, grain binding, L. Miller 451,975
Hatch door, J. J. McBride 451,947
Hay rake and tedder, combined, M. Rew 452,319
Heater. See Car heater. Feed water heater. Water heater.
Heating apparatus, steam, W. E. Hall 451,929
Heating by electricity, apparatus for, C. Zipernowsky 452,056
Heel burnisher, A. L. F. Mitchell 452,032
Heel burnishing machine, Fowler & Warren 452,345
Heel burnishing machine, A. L. F. Mitchell 452,033
Heel cutting machine, W. E. Cummings 451,917
Hinge, lock, T. Corscaden 451,969
Holder. See Air brake hose holder. Bag holder. Brush holder. Cuff holder. Lamp holder. Pen holder. Umbrella holder. Sash holder. Shade holder. Work holder.
Hook. See Suspender hook. Swivel hook.
Hot air furnace, G. W. Walker 451,962
Ice cream freezer, T. G. Palmer 452,315
Indicator, J. S. Reamer 452,111
Inhaler, G. Elliott 451,998
Injector for feeding steam boilers, J. W. Binder 452,175
Inkstand, W. H. Berry 452,252
Insulator, electric, S. Oakman 451,950
Iron or tin from waste material in old cans, etc., manufacture of taggers, W. L. Brockway 452,069
Ironing board, J. L. Means 451,945
Jack. See carriage jack. Lasting jack.
Juice extractor, Castanos & De Lara 452,213
Kitchen cabinet, Allen & Lindsey 452,307
Knitting machine, straight, P. P. Olsson 452,018
Lamp crane, electric, E. Cardarelli 452,211
Lamp drop, electric, W. E. Dow 451,996
Lamp holder, portable electric, W. W. Savage 452,288
Lamp, incandescent electric, Keen & Haarmann 452,305
Lamp socket, incandescent, W. M. B. Keen 452,306
Lamp wick, A. E. Harris 452,103
Lasting jack, R. Nagle 452,146
Lasting machine, J. Patten 452,316
Lead, making white, E. W. Dahl 452,263
Letter box, house door, E. C. Hudson 452,223
Life lines, safety hook for, E. H. Smith 452,199
Lifter. See Butter lifter.
Limb, artificial, T. Sparham 452,048
Locomotive for tramways, C. D. Scott 452,124
Loom, E. Wright 452,328
Loom, lappet, J. W. Cheney 451,914
Loom picker staff check, E. J. Ellis 452,265
Looms, friction let-off device for, O. W. Schaum 452,021
Lubricator. See Cylinder lubricator.
Lubricator, A. C. Ellithorpe 452,101
Lubricator, G. T. Reiss 452,318
Magnet, electro, C. E. Lipe 452,005
Mail bag catcher, A. B. Wood 452,300
Mail bag fastening, R. T. Smith 452,148
Mail box, foldable, J. F. Deeves 452,071
Manual motor, D. R. Sheen 452,085
Mat. See Self-inflating mat.
Measure, tailor's, J. Walkie 452,090
Measuring instrument, electrical, E. Weston 452,326
Metals from their ores, apparatus for extracting, W. Von Siemens 452,125
Meter. See Electric meter.
Mill. See Fulling mill. Pug mill. Rolling mill.
Mining machine, coal, Wantling & Johnson 451,988
Molding cutter, R. E. Linham ..... 452,309, to 452,311
Motor. See Car motor. Electric motor. Manual motor. Water motor.
Motor switch, self controlled, G. H. Whittingham 452,151
Muffler, S. F. Prince, Jr 452,020
Music sheet for mechanical musical instruments, W. A. Webber 452,203
Music sheets, device for turning, H. Nothhaas 451,976
Musical instrument, J. S. F. Pizzuti 452,193
Obstetrical forceps, W. H. Hamilton 451,930
Oil burner, Page & Stewart 452,314
Operating table, J. Atkinson 452,331
Paper box, angular, D. S. Clark 452,164
Paper box machine, Putt & Neeff 452,317
Paper, machine for cutting sheets from webs of, J. A. Dear 452,025
Paper pulp, apparatus for bleaching, J. Jordan 452,074
Paper, sizing, W. J. Menzies 452,143
Paper tubes, machine for rolling, J. Liddell 452,141
Paving machine, power street, F. A. Huntington 452,184
Paving plant, portable, S. Whinery 451,989
Pen holder, W. R. Hoffmann 452,013
Pencil, L. H. Sondheim 452,242
Pencil sharpener, A. J. Hood 452,270
Photographic camera, B. J. Edwards 452,119
Photographic purposes, calender for, A. Leutner 452,059
Piano, G. Steck 452,006
Picker. See Fruit picker.
Pin. See Hairpin.
Pipe. See Drain pipe.
Pipe clamp, W. Lee 452,307
Pipe making apparatus, J. Simpson 452,114
Planter, cotton, M. H. & T. D. Owen 452,313
Plastering compound, I. C. Hart 452,346
Plastic ornaments on profiled borders, etc., apparatus for producing, Weies & Gassen 452,204
Plow, L. F. Haynes 451,931
Plow attachment, etc., C. E. Wilson 451,966
Plow beams, adjustable connection for, A. T. Scott 452,321
Pocket book fastening, B. Lehmann 452,039
Portable furnace, N. T. Edson 452,118
Pottery ware, decorating, B. Booth 452,254
Power wrench, J. R. Robinson 452,237
Press. See Embossing and printing press. Printing press.
Primary battery, W. Hanson 452,303
Printer's chase, H. P. Feister 451,923
Printer's quoin, W. Wickersham 451,990
Printing machine, block, G. E. Hamblet 452,038
Printing machines, cutting and switching mechanism for web, J. H. Stonemetz 452,243, 452,244
Printing press, W. Scott (r) 11,166
Printing press feed gauge, W. Bartlett 452,022
Printing press, hand, B. B. Hill 451,971
Printing presses, folding machines, etc., feeding paper to, J. A. Dear 452,024
Pug mill, L. W. Nuebling 452,147
Pump, steam vacuum, G. E. Nye 452,080
Puzzle, N. A. Swett 451,958
Rack. See Show rack.
Radiator, P. B. Fox 452,028
Radiator, F. Marak, Jr 451,944
Railway earth scraper, W. Gravit 452,130
Railway, electric, F. O. Blackwell 452,160
Railway, electric, M. W. Dewey 452,099
Railway gate, N. Newman 452,190
Railway gate, Wood & Smith 452,301
Railway rail and pavement, street, P. Bargion 452,333
Railway rails, rolls for reducing old, C. R. Bryson 452,095
Railway signal, automatic, J. W. Richardson 452,285
Railway signal, electric, W. C. Walter 451,999
Railway signaling apparatus, automatic, S. J. Doucet 452,072
Railway signaling device, J. C. O'Neil 452,281
Railway switch, portable, W. O. Cooke 452,261
Railways, overhead track for, E. H. Thatcher 452,201
Railways, tubular pole for electrical, T. J. Bray 452,255
Rake. See Hay rake.
Razor strop, M. E. Reilly 452,112
Reel. See Clothes line reel.
Register. See Cash register. Fare register.
Riveting apparatus, electric, E. E. Reis 452,042
Rocking board, extensible, N. P. Benson 451,994
Rolling mill, J. Jardine 451,934
Rolling tubes, machine for, T. J. Bray 451,912
Roof coating, composition for, W. S. Smith 452,086
Roundabout, M. M. Holmes 451,932
Roundabout, W. Mangels 452,227
Sash balance, J. S. Baker 452,208
Sash balance, R. Burgess 452,258
Sash balance, J. N. Weiser 452,249
Sash balance, C. E. Whipple 452,297
Sash fastener, M. Sonneschein 452,200
Sash holder, E. Haueisen 452,269
Sash, railway car or other window, S. Collins 452,098
Sausage machine, E. Rogers 452,238
Saw gummer, Baird & Holloran 452,157
Saw machine, self-feeding rip, F. McDonough 452,110
Scales, automatic grain weighing, Gunder & Pierce 452,029
Scale, micrometer, C. Sperry 452,054
Scale, spring, J. S. McIlvaine 452,278
Scale, weighing and price, W. J. Humphreys 452,224
Screw heads, die for slotting, C. D. Rogers 452,064
Screw, jack, M. D. Kalbach 452,225
Seal, C. D. Ives *et al* 452,050
Secondary battery, J. Emmner, Jr 451,921
Self-inflating mat or cushion for sliding poles, E. L. Perry 452,234
Separating machine, O. M. Morse (r) 11,165
Separator, G. L. Dale 451,918
Sewing machines, thread-controlling mechanism for, J. E. Bertrand 452,159
Shade holder, J. Lines 452,167
Shaft bending machine, H. Cobb 452,339
Shears, T. F. Calahan 452,260
Shipping and storage box, Moore & Wolf 452,232
Shirt, G. D. Eighmie 452,178, 452,180
Shirt sleeve, G. D. Eighmie 452,179
Shoe tree, H. G. Locke *et al* 452,142
Show rack, T. R. Boone 451,911
Show stand, J. Davies 451,919
Sieve, grain, J. S. & T. B. Rowell 452,065
Signal. See Railway signal.
Signaling device, electrical, C. J. Kintner 452,026
Slicer, apple, I. Platschart 452,034
Smoke consumer, F. T. Robinson 451,977
Sodium and potassium, manufacturing, H. Y. Gastner 452,030
Sole trimming machine, A. S. Vose 452,027
Spacing instrument, J. T. Pedersen 452,019

© 1891 SCIENTIFIC AMERICAN, INC.

Spectacles, T. A. Willson.....452,008, 452,009
Spinning machines, spindle driving mechanism for, E. A. Baldwin..... 452,332
Split switches, slide plate appliance for, A. A. Strom..... 452,323
Spring, J. H. Sullivan..... 452,088
Sprinkler head, G. W. Young..... 452,329
Stamp applying device, W. B. Bunker..... 452,257
Stand. See Display stand. Show stand. Trolley stand.
Stave making machinery, F. H. Brown..... 452,094
Steam engine, oscillating, H. L. Wilson..... 452,236
Steam trap, F. Funke..... 452,123
Steam trap, H. C. Stifel..... 452,294
Steel, toughening, J. Coffin..... 452,031
Stone composition, artificial, J. F. St. John..... 452,037
Stove attachment, C. P. Johnson..... 451,935
Stove, oil, L. T. Wilcox..... 451,964
Stoves or furnaces, air heating and ventilating apparatus for, J. A. Kirkpatrick..... 452,105
Strainer, milk, C. C. Daly..... 452,264
Street cleaning machine, J. W. Wood..... 452,153
Stump extractor, J. Cornelius..... 452,215
Sugar, apparatus for the manufacture of, L. E. A. Prangey..... 452,062
Sugar, manufacture of refined, L. E. A. Prangey.. 452,063
Surgical electrode, J. H. Gunning..... 452,220
Suspender hook, E. R. Dobbs..... 452,217
Sweeping machine, J. S. Goodnow..... 451,927
Switch. See Motor switch. Railway switch.
Swivel hook, E. L. Robinson..... 452,320
Syringe, vaginal, J. W. Haughawout..... 452,222
Table. See Operating table.
Table, E. W. Clark..... 452,117
Table, J. A. Meyer..... 451,946
Tacking machine, J. E. L. Bradeen..... 451,995
Tag attaching machine, E. G. Cohen..... 452,097
Tag making and printing machine. W. P. Kidder.. 452,076
Teaching arithmetic, device for, J. Denison..... 452,302
Telegraph, printing, E. Pope..... 451,951
Telemeter, optical, A. A. Michelson..... 452,060
Thermostat, A. M. Butz..... 452,163
Thill coupling, A. Plicque..... 452,236
Thrashing machines, band cutter and feeder for, Epps & Kibbee..... 452,266
Tile, manufacturing, M. Scott..... 452,113
Tiles, hardening and coloring alabaster, E. Topi.. 452,295
Tire for vehicles, rubber, N. Yagn..... 452,001
Tobacco package and wrapper for the same, T. J. Maloney..... 452,109
Toll box, automatic, I. H. Farnham..... 451,922
Tooth, artificial, E. C. Taylor..... 451,959
Tramway system, compressed air, F. H. Richards, 452,051, 452,052
Transplanter, plant, C. T. Fountain..... 452,181
Trap. See Animal trap. Steam trap.
Trap, D. M. Ireland..... 451,973
Trimmer. See Wick trimmer.
Trolley stand, R. M. Jones..... 452,186
Truck, car, C. W. Hunt.....452,134 to 452,136
Truck, car, J. T. Robinson..... 451,952
Truck, motor, F. M. Lechner..... 451,942
Type writing machine attachment, A. C. Albright 452,057
Typewriting machine, F. H. Bolte..... 452,235
Typewriting machine, J. B. Gathright..... 452,268
Typewriting machine, T. W. Searing..... 452,290
Umbrella holder, B. J. Bonn..... 452,253
Valve controlling apparatus, C. Kammerer..... 451,937
Valve for gas burning furnaces, J. W. Higgs..... 452,347
Valve, muffled pop safety, A. C. Meady..... 452,230
Valve, steam, water, and fluid, F. M. Metcalf..... 452,312
Vehicle runner, wheeled, T. Reece..... 452,083
Vehicle step, G. H. Schweiger..... 452,198
Vehicle wheel, A. C. Mather..... 452,046
Velocipede, J. Breitenmoser..... 452,336
Velocipede, M. Redlinger..... 452,082
Vending device, coin-operated liquid, Bacon & Hill..... 452,092
Veneer cutter, band saw, C. W. & A. S. Gage..... 452,219
Vessel, screw propelled, C. G. Lundborg..... 452,108
Wagon, buckboard, G. T. Chapman..... 452,338
Warping machine attachment, T. A. Davis..... 452,127
Washing machine, C. O. Garrison..... 452,129
Watch case opener, D. Southworth..... 451,982
Water heater, J. F. McElroy..... 452,145
Water motor, E. Harryman..... 452,221
Weather strip, A. La Jeunesse..... 452,106
Weighing and strength testing machines, counterpoising apparatus for, G. E. Rutter..... 451,955
Wheel. See Vehicle wheel.
Wheel, A. C. Mather..... 452,047
Whiffletree clip, Hendrick & Hewlett..... 452,120
Whip, G. E. Whipple..... 452,327
Wick trimmer, R. H. Scott..... 452,289
Winding and spinning machines, faller for the stop motion of, V. Royle..... 452,066
Wire clamp, R. M. Jones..... 452,185
Wire drawing machine, J. & W. Jolly..... 451,936
Work holder, J. L. Fritz..... 451,925
Wrench. See Power wrench.
Wrench, J. A. Abbotts..... 451,991

TRADE MARKS.

Basins and pitchers, wash, J. J. Royle..... 19,492
Beer, lager, J. Conrad..... 19,464
Belts, driving, Rossendale Belting Company..... 19,470
Cigars, M. Alvarez.....19,495, 19,496
Cigars, Chao, Alvarez & Co.....19,497, 19,498
Cigars, L. W. Davis..... 19,499
Cigars, R. Lopez..... 19,506
Cigars, J. Menendez..... 19,504
Cigars, J. S. Murias & Co..... 19,478
Cigars, B. Suarez y Gonzales..... 19,507
Collars and cuffs, men's, Moseley & Moody..... 19,467
Cutlery and razors, pocket, Canton Cutlery Company..... 19,480
Filter presses, Niles Tool Works..... 19,468
Finger rings, Palmer & Capron..... 19,459
Finger rings, plated, Palmer & Capron..... 19,460
Flour wheat, L. M. Godley & Co..... 19,477
Game of jackstraws, E. I. Horsman..... 19,465
Gunpowder, Hazard Powder Company..... 19,505
Harmonicas, Weiller & Sons..... 19,508
Jams, jellies, marmalades, and preserves, R. Gordon..... 19,484
Knit underwear, S. Wright..... 19,494
Lamps, burners for central draught, Rochester Lamp Company..... 19,479
Leather dressing and metal polish, Ames & Son.... 19,449
Liniments, ointments, salves, and condition powders for horses, Superior Horse Foot Oil Company..... 19,473
Milk coagulating products, Nutriment Company... 19,482
Musical instruments, L. Lowenthal..... 19,466
Paint, C. T. Raynolds & Co..... 19,491
Paints, F. C. Knowles & Company..... 19,485
Paints and colors, C. T. Raynolds & Co..... 19,490
Paper, fine writing, Southworth Company..... 19,461
Paper making, pure gypsum for, H. C. Hulbert..... 19,453
Petroleum, refined, H. W. Peabody & Co..... 19,469
Photographic dry plates, J. Carbutt..... 19,476
Pickles and relishes, Lutz Bros..... 19,486
Poison, rat, F. Schoureck..... 19,472
Preserved vegetables, meats, fish, and fruit, H. Lins & Sons..... 19,488
Remedy for chapped face and hands, liquid, H. Lambeck, Jr..... 19,463
Remedy for rheumatism, gout, and neuralgia, A. Lilly..... 19,454
Salt, table, A. Kerr, Bro. & Company..... 19,502
Shirts, W. M. Steppacher..... 19,471
Shirts, collars, and cuffs, Firm of J. Wanamaker... 19,475
Soap powder, toilet, C. Davis & Co..... 19,500
Soap, toilet, N. B. Lichty..... 19,503
Steam engines, A. L. Ide & Son..... 19,501
Tea, Ceylon Planters' Tea Company.....19,481 to 19,483
Tin plates, Amman Iron Co.....19,446 to 19,448
Tin plates, T. B. Coddington & Co.....19,450, 19,451
Tin plates, Phillips, Nunes & Co.....19,455 to 19,458
Typewriters, ribbons and carbon and linen papers for, Wyckoff, Seamans & Benedict..... 19,462
Underwear, L. Maier..... 19,489
Vanilla, crystallized flavoring simulating, G. H. Lowell..... 19,487
Wool prepared for the market, Catton, Bell & Co.. 19,452

DESIGNS.

Cards, backs for playing, S. L. Cohen..... 20,717
Casket handle ear, M. Bremer..... 20,714
Game counter, H. W. Harris..... 20,713
Harness, box loop for, E. Fox.....20,718 to 20,720
Paperweight, W. H. Allen..... 20,716
Perfumery vending apparatus, standard for, O. Giannini..... 20,721
Toilet powder box and perfumery holder, J. F. Lockwood..... 20,715

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print, issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. **Other foreign patents may also be obtained.**

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in next issue.

USE ADAMANT WALL PLASTER

It is **Hard, Dense, and Adhesive.** Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling.

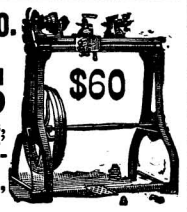
Address **ADAMANT MFG. CO.**
309 E. Genesee St., Syracuse, N. Y.

Patent Foot Power Machinery
Complete Outfits.

Wood or Metal workers without steam power, can successfully compete with the large shops, by using our New **LABOR SAVING Machinery,** latest and most improved for practical shop use, also for Industrial Schools, Home Training, etc. Catalogue free.
Seneca Falls Mfg. Co.
695 Water Street, Seneca Falls, N. Y.

ADVERTISING SPECIALTIES! Inventors can sell us outright or have manufactured on royalty, inventions of novelty or utility that can be used for advertising. Correspondence invited. The Tuscarora Advertising Co., Coshocton, O.

The Sebastian-May Co.
Improved Screw Cutting
Foot & Power **LATHES**



Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.
165 to 167 Highland Ave., SIDNEY, OHIO.

TALCOTT'S COMBINATION
PATENT BELT HOOKS,
W. O. TALCOTT, Providence, R. I.

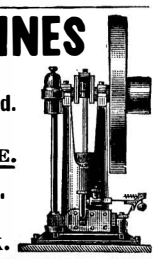
ELECTRO MOTOR. SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

THE DAIMLER MOTOR
THE DAIMLER MOTOR CO.
is prepared to furnish **1, 2,** and **4 Horse Power**
GAS or PETROLEUM MOTORS
for all Industrial Purposes. *Fully illustrated catalogue and price list on application.* Motors in operation at Works, Steinway, Long Island City.
Office, 111 East 14th Street, New York City.

STEVENS PATENT
SPRING SCREW THREAD CALIPERS
Ideal, No. 64.
Price, by mail, postpaid.
3 inch.....$1.00 | 5 inch.....$1.25
Ideal and Leader Spring Dividers, and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 280, Chicopee Falls, Mass.

ON GAS ENGINES.—A VALUABLE paper by E. Delamare-Debouteville, touching upon the history of gas motors in general, and describing in detail the "Simplex" engine invented by the author and Mr Malandin. With 23 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **715** and **716.** Price 10 cents each. To be had at this office and from all newsdealers.

OTTO GAS ENGINES
33,000 SOLD.
Engines and Pumps Combined.
For COAL GAS or GASOLINE.



SCHLEICHER, SCHUMM & CO.
PHILADELPHIA,
CHICAGO, NEW YORK.

PATENTS!

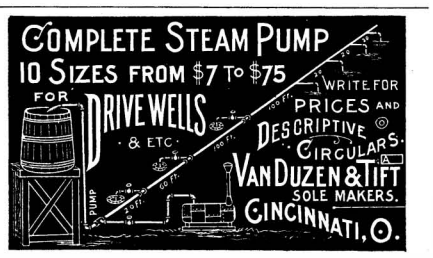
MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-five years' experience,* and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge,* a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.



LIST OF BOOKS ON
ELECTRICITY

Art of Electrolytic Separation of Metals. By G. Gore. Theoretical and practical. Fully illustrated. 8vo, cloth. London, 1890.....**$3.50**

Arithmetic of Electricity. By T. O'Conor Sloane, A.M., E.M., Ph.D. This work gives Electric Calculations in such a simple manner that it can be used by any one having a knowledge of Arithmetic. It treats of calculations for wiring, resistance in general, arrangement of batteries for different work, and is supplemented by the most practical series of tables ever published. It is absolutely indispensable to the practical electrician, as well as to the amateur. Fully illustrated. 1891....**$1.00**

Bellhangers' Hand Book. With 97 illustrations. By F. B. Badt, author of "Dynamo Tenders' Hand Book." 1890.....**$1.00**

Dynamo Tenders' Hand Book. A practical guide for the operation of Electric Light Installations, giving, with the exclusion of all scientific terms, plain information on electrical terms, arrangement of power, theories of dynamos, diseases of dynamos, lamps, instruments, circuits, accumulators, safety regulations, construction of tools, and in addition several useful tables. By F. B. Badt. With 70 illustrations....**$1.00**

Dynamos and Electric Motors, and all about them. By Edward Trevert. Illustrated. 1891 ... **.50**

Dynamo Electric Machines. Principles of, and Practical Directions for Designing and Constructing Dynamos, with an Appendix containing several articles on allied subjects, and a Table of Equivalents of Units of Measurement. By Carl Hering. N. Y., 1890..**$2.50**

Dynamic Electricity and Magnetism. The Elements of a Complete Comprehensive Treatise on the Principles of Practical Electricity, in the author's well known clear, unmathematical style. By Philip Atkinson, A.M., Ph.D., containing 405 pages. 120 illustrations. 12mo. 1891.....**$2.00**

Electricity. The A B C of. An elementary manual giving in simple language a general outline of the science. 108 pages, with 36 illustrations. Wm. H. Meadowcroft. 12mo, cloth, 1890..... **.50**

Electric Lighting. The Elements of Electric Lighting, including Electric Generation, Measurement, Storage, and Distribution. By Philip Atkinson, A.M., Ph.D., author of "Elements of Static Electricity." Contents: Electricity a Mode of Molecular Motion; Alternate Current Dynamos; Direct Current Dynamos; Electric Terms and Units; Electric Measurement; The Arc Lamp; The Incandescent Lamp; The Storage Battery; Electric Distribution, etc. Fourth edition. 260 pages. 104 illustrations. 1890.....**$1.50**
This is a very complete work, and should be in the hands of all who have to do with electric lighting apparatus of any kind whatever.

Electrical Influence Machines. By John Gray. A full account of their Historical Development and Modern Forms, with instructions for making them. Cloth, 237 pages, 89 illustrations.....**$1.75**

Electric Light Fitting. A Hand Book for Working Electrical Engineers, embodying Practical Notes on Installation Management. By John W. Urquhart, with numerous illustrations. London, 1890.....**$2.00**

Electric Batteries. Elementary Treatise on. From the French of Alfred Niaudet, translated by L. M. Fishback. Fifth edition. N. Y., 1890.....**$2.50**

Electricity in our Homes and Workshops. A practical Treatise on Auxiliary Electrical Apparatus. With numerous illustrations. Sydney F. Walker. 12mo, cloth. London, 1889.....**$1.50**

Electrical Instument Making for Amateurs. By S. R. Bottone. A practical hand-book. Cloth, 175 pages. 59 illustrations..... **.50**

Electrical Rules and Tables. A pocketbook of Electrical Rules and Tables for the use of Electricians and Engineers. Revised and enlarged. 498 pages. 32mo, Roan. Sixth edition. 1891.....**$2.50**

Electricity and Magnetism. Elementary Lessons in Electricity and Magnetism. By Sylvanus P. Thompson. 171 illustrations and 442 pages. 1891.....**$1.25**

Electrical Dictionary. A Dictionary of Electrical Words, Terms, and Phrases. By Edwin J. Houston, A.M., Electrician of the International Electrical Exhibition. 640 pages and 396 illustrations. 1889.....**$2.50**
The author has aimed to give a concise definition of the word, term, or phrase, and a brief statement of the science involved in the definition, and to insert when possible, a cut of the apparatus described or employed in connection with the word, term, or phrase defined.

Electrical Engineering. By W. Slingo and A. Brooker. A Practical Book for Electric Light Artisans and Students. This is a Comprehensive Treatise on the more Important Modern Applications of Electricity. 630 pages. 300 illustrations.....**$3.50**

Electro-Motors, How Made and How Used. By S. R. Bottone. A Handbook for Amateurs and Practical Men. Illustrated. This book was originally prepared chiefly as letters, in reply to queries addressed to the Author on the construction of electro-motors, on their many modifications, and on their mode of workings. 12mo, cloth. London, 1890.....**$1.20**

Electro-Deposition. A Practical Treatise on the Electrolysis of Gold, Silver, Copper, Nickel, and other Metals and Alloys, with descriptions of Voltaic Batteries, Magneto and Dynamo Electric Machines, Thermopiles, and of the Materials and Processes used in every department of the Art, and several chapters on Electro-metallurgy. By Alexander Watt, author of "Electro-metallurgy." "The Art of Soap Making," etc., etc. With numerous illustrations. Third edition. Revised, corrected, and enlarged. London, 1889.....**$3.50**

Electricity for Engineers. By Charles Desmond. A Clear and Comprehensive Treatise on the Principles, Construction and Operation of Dynamos, Motors, Lamps, Indicators, and Measuring Instruments, also a Full Explanation of the Electrical Terms used in the work. Illustrated by nearly 100 Engravings, in 1 Volume. 12mo, 255 pages. Price.....**$1.50**

Electric Bells and All About Them. By S. R. Bottone. A Practical Book for Practical Men. With more than 100 Illustrations. 12mo, cloth. Price reduced to..... **.50**

Electric Light Installations and the Management of Accumulators. A Practical Handbook by Sir David Salomons, Bart., M. A., Assoc. Inst. C. E., member of Council of the Society of Telegraph Engineers and Electricians, member of the American Institute of Electrical Engineers. Fifth edition, revised and enlarged. With 99 illustrations. 348 pages. 12mo, cloth.....**$1.50**

Experimental Science. By Geo. M. Hopkins. Natural Philosophy without a Teacher Simplified. Interesting Experiments in Every Branch of Physics. Descriptions of Simple and Efficient Apparatus, much of which may be Made at Home. Among Subjects treated are Electricity in all its Branches, Magnetism, Heat, Light, Photography, Microscopy, Optical Illusions, Mechanics, etc. A world of Valuable Information. A Source of Rational Amusement. A superb work for Young and Old. 740 pages, nearly 700 first-class engravings. Elegantly bound in cloth. 1891.....**$4.00**

Incandescent Wiring Handbook. With 35 illustrations and 5 tables by F. B. Badt, late First Lieut. Royal Prussian Artillery, and author of "Dynamo Tenders' Handbook," "Bell Hangers' Handbook." 1890.....**$1.00**

Lectures on the Electro-Magnet. By Sylvanus P. Thompson. Authorized American Edition. Just Published. Cloth. 1891.....**$1.00**

Practical Electric Bell Fitting. A Treatise on the Fitting-Up and Maintenance of Electric Bells, and all the necessary apparatus. By F. C. Allsop. With nearly 150 illustrations. 1889.....**$1.25**

Practical Electricity. A Laboratory and Lecture Course for First Year Students of Electrical Engineering based on the Practical Definitions of the Electrical Units. By W. E. Ayrton, F.R.S. Nearly 500 pages, and 180 illustrations. Third edition. 1890.....**$2.50**

Practical Electrics.—A Universal Hand-book on every-day electrical matters, including connections, alarms, batteries, bells, carbons, induction, intensity and resistance coils, dynamo-electric machines, fire risks, measuring, microphones, motors, phonographs, photophones, storage and telephones. Being the Electrical portion of the "Third Series of Workshop Receipts." 135 pages, 12mo, cloth. 1890..... **.75**

Telephone.—The Electric Telephone. By George B. Prescott. Second edition, revised and enlarged. 512 illustrations. 790 pages. 1890.....**$6.00**

☞ Any of the above books promptly sent by mail, postpaid, on receipt of the price, by

MUNN & CO.,
Publishers of the "Scientific American,"
361 Broadway, New York.

☞ *Send for our New and Complete Catalogue of Books, sent free to any address.*

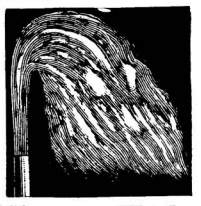
ELECTRICAL!
Novelty Grenet battery for experimental use, $1.25 each. The lowest priced battery having high electro motive force. Novelty Disque Battery for Electric Bells, 50c. each per hundred.
NOVELTY ELECTRIC CO., 54 North 4th St., Phila., Pa.

"Improvement the order of the age."
THE SMITH PREMIER TYPEWRITER

Important Improvements.
All the Essential Features greatly perfected.
The Most Durable in Alignment.
Easiest Running and Most Silent.
All type cleaned in 10 seconds without soiling the hands.
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.
Send for Catalogue.

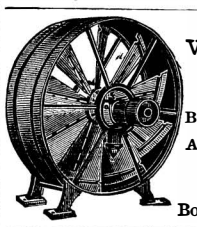
OIL WELL SUPPLY CO.
91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.

STEREOTYPING; THE PLASTER AND Paper Processes.—Composition and preparation of the mould, the best alloys of metal and proper degree of heat, trimming and mending the plate, etc. A minute description of both processes, with numerous illustrations. A paper of great interest to every printer. By Thomas Bolas, F.C.S., F.I.C. SCIENTIFIC AMERICAN SUPPLEMENTS, **773** and **774.** 10 cents each.



ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

GEAR CUTTING
Leland, Faulconer & Norton Co., Detroit, Mich

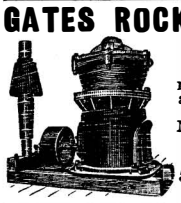


CLARK'S
Ventilating and Drying
FANS.
Light Running, Adjustable Blades, Self-Oiling Bearings.
24-page catalogue free.
Also Rubber Press Rolls for Wool and Yarn Washing and Dyeing Machines.
GEO. P. CLARK, Manuf.
Box L. **Windsor Locks, Ct.**

STEREOTYPING.—A VALUABLE series of lectures by Thomas Bolas, discussing the most recent methods in this branch of typography. With 23 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **773** and **774.** Price 10 cents each. To be had at this office and from all newsdealers.

UNION MANUFACTURING & PLATING CO.
236-238-240 Carroll Ave., Chicago, Manufacturers of
METAL SPECIALTIES FOR INVENTORS.
ALL KINDS OF PLATING.
Estimates furnished. Correspondence invited.

GATES ROCK & ORE BREAKER



Capacity up to 200 tons per hour.
Has produced more ballast, road metal, and broken more ore than all other Breakers combined.
Builders of High Grade Mining Machinery.
Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
215 Franklin St., Boston, Mass.

HOW TO MAKE DYNAMO-ELECTRIC Machines.—By Geo. M. Hopkins. With drawings to scale and full directions for constructing dynamos of different sizes. The small machine is intended for experimental purposes. Will heat from 4 to 6 inches of platinum wire, produce the electric light, decompose water rapidly, magnetize steel, ring a large gong, give powerful shocks, operate induction coils, and will, for temporary use, replace 8 or 10 Bunsen cells. Contained in SUPPLEMENTS **161** and **599.** Price 10 cents each. The larger machine produces eight 16-candle lights or one powerful arc light. Can be arranged as a series, shunt, or compound wound machine. Can be run for a short time by two or four men. Requires one horse power for continued running. Best engravings of dynamo ever produced. Details of every part shown. Winding of armature and field magnet plainly illustrated. Any intelligent person with the aid of these drawings and instructions may make useful, durable, and effective machines. Contained in SUPPLEMENT **600.** Price 10 cents. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

STEEL TYPE FOR TYPEWRITERS

Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N.Y

GOLD-SILVER-NICKEL PLATING
A trade easily learned; costs little to start. I will furnish outfits and give work in part payment. Circulars free. Address **F. LOWEY, Box 139, Brooklyn, N. Y.**

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.

WOODEN TANKS.
FOR RAILROADS, WATER WORKS, MILLS, FARMS &C.
LARGE WATER TANKS.
PLANS & ?A SPECIALTY.
COMPLETE STOCK OF CYPRESS LUMBER.
SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS.
W. E. CALDWELL & Co
N° 217 E. MAIN ST. LOUISVILLE KY.

Stored Energy
ACCUMULATORS for Electric Lighting and Street Car Propulsion.
THE ACCUMULATOR COMPANY,
44 Broadway, N. Y. City. 224 Carter St., Phila., Pa.

© 1891 SCIENTIFIC AMERICAN, INC.

Founded by Mathew Carey. 1785.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞Our new and Revised Catalogue of Practical and Scientific Books, 86 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

HARPER'S PERIODICALS

HARPER'S MAGAZINE, One Year - - $4.00
HARPER'S WEEKLY, One Year - - - - 4.00
HARPER'S BAZAR, One Year - - - - 4.00
HARPER'S YOUNG PEOPLE, One Year - 2.00

☞*Postage free to all subscribers in the United States, Canada, and Mexico.*

The volumes of the WEEKLY and BAZAR begin with the first numbers for January, the volumes of the YOUNG PEOPLE with the first number for November, and the volumes of the MAGAZINE with the numbers for June and December of each year.

Booksellers and Postmasters usually receive Subscriptions. Subscriptions sent direct to the publishers should be accompanied by Post Office Money Order or Draft. When no time is specified, subscriptions will begin with the current Number.

The MAGAZINE is an overflowing store of good literature and exquisite art—a delightful production deserving all the fame and all the material success which have been won by it. The WEEKLY is a rarely illustrated chronicle of the year's events. There is no end of pleasure and profit in its pages. . . . The BAZAR is a repository of fashion, and a gallery of some of the finest engravings of the time. . . . The YOUNG PEOPLE is a treasure-house, fascinating to every boy and girl as well as to plenty of persons older. A remarkable and valuable, an instructive and delightful line of publications, indeed.—*N. Y. Sun.*

Address
HARPER & BROTHERS,
NEW YORK.

FOREIGN PATENTS
THEIR COST REDUCED.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad.

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st, 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well projected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India Australia, and the other British Colonies.

An experience of over FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and other information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

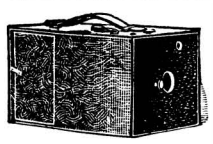
A NEW CATALOGUE OF VALUABLE PAPERS

Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.

MUNN & CO., 361 Broadway, New York.

FIRE FELT.

THE NEW NON-CONDUCTING MATERIAL is a Flexible Felt **Made of Pure Asbestos,** in a finely divided fibrous state, indestructible by heat and unexcelled as a Non-Conductor. U. S. Navy tests show it to be superior to Hair Felt in Non-Conducting qualities. Made into sectional form for pipes and into sheets and rolls for large surfaces. Send for Samples.
Asbestos Boiler Coverings, Steam Packings, Asbestos Cloth, Asbestos Building Paper, etc.
THE CHALMERS-SPENCE CO., 59 and 61 Liberty St., New York.
BRANCHES:—Philadelphia, Chicago, Pittsburgh, Boston.



THE MONTAUK CAMERA.

Is compact and neat, covered with seal leather, supplied with double rapid rectilinear lens. Takes snap shots, interiors, exteriors, houses, groups, etc. Size of picture, 4 x 5 inches.

Sample pictures and instruction books furnished for 10 cents. For circulars, address
G. GENNERT,
56 East 10th St., New York.

The Caligraph.

LIFE IS TOO SHORT TO WRITE THE OLD WAY

Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway.

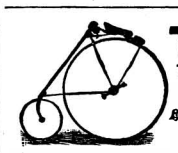
PATENTED NOVELTIES
OF MERIT sold for the manufacturer or inventor. H. B. HARFORD & SON, 134 Van Buren St., Chicago, Ill.

EVERY USER OF MACHINERY SHOULD LEARN
How to Use Loose Pulleys.
Useful information on this subject is given in our "Catalogue No. 56." Sent free to any address.
VAN DUZEN & TIFT, Cincinnati, Ohio.
— MENTION THIS PAPER. —

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.

Barnes' Foot-Power Machinery
Complete outfits for Actual Worksnop Business. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around." Descriptive Price List Free.
W. F. & JOHN BARNES CO.,
1999 RUBY ST., Rockford, Ill.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.



THE EAGLE
THE EASIEST RUNNING BICYCLE IN THE WORLD.
☞Speed, Comfort and Safety.
AGENTS WANTED.
Large Illustrated Catalogue sent Free to any Address.
THE EAGLE BICYCLE MFG. CO.,
STAMFORD, CONN.

A LIBRARY FOR $1.00

Five books in one. Worth its weight in gold to every mechanic. The very latest information for 20 different trades. This wonderful book contains 575 pages absolutely teeming with rules, tables, secret processes, and new information that cannot be had elsewhere for less than $25.00. The Modern Steam Engine—How to Read an Indicator—The Westinghouse Air Brake—Blacksmith's and Machinist's Tools—Practical Mathematics Simplified—Tin and Sheet Iron Worker's Manual—Carpenter's Manual—Points for Painters—Magnetism and Electricity—How to Get a Patent—A Mechanical Dictionary. Everything fully explained in one handsome volume and guaranteed to be absolutely correct. Send $1.00 for a copy bound in silk cloth, or $1.50 for Morocco binding. With each copy of the book we give free a complete working chart for setting gear teeth. The regular price of this chart is $1.50. **AGENTS WANTED.** Write for terms. **LAIRD & LEE, Publishers, 263 Wabash Avenue, Chicago, Ill.**

FAMILY ICE MACHINE Ice, etc., in a few minutes. $10 & up. L. Dermigny, 126 W. 25th St., N. Y. *State Rights for sale.*

DEAFNESS & HEAD NOISES CURED by Peck's Invisible Tubular Ear Cushions. Whispers heard. Successful when all remedies fail. Sold only by F. Hiscox, 853 B'way, N.Y. Write for book of proofs **FREE**

TYPEWRITERS.
New or Second-Hand, any make, bought, sold and exchanged. Get our prices. Everything guaranteed. Machines rented anywhere. New catalogue describing all machines, free. NATIONAL TYPEWRITER EXCHANGE, 200 S. La Salle Street, CHICAGO, ILL.

BLUE PRINT Paper, Superior Quality. **Photographic Supplies.** Send for catalogue.
T. H. McCOLLIN & CO., 1030 Arch Street, Philadelphia.

HARRISON CONVEYOR!
For Handling Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.
Send for Circulars. | BORDEN, SELLECK & CO., { Sole Manu'fers, } Chicago, Ill.

ICE and REFRIGERATING MACHINES
The Pictet Artificial Ice Company (Limited), Room 6, Coal & Iron Exchange, New York.

Burnham's New Improved Standard Turbine
Vertical or Horizontal. Yields a greater percentage of water used, either with full or part gate drawn, and is the simplest constructed and best finished wheel in the market. Can fill your order promptly. BURNHAM BROS., YORK, PA.

ATMOSPHERIC DUST.—BY WILLIAM Marcet, F.R.S. An address delivered to the Royal Meteorological Society. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **755.** Price 10 cents. To be had at this office and from all newsdealers.

THE PREMIER CAMERA

IS THE BEST IN MARKET.

Simple of Manipulation.
Plates or Films are used.
The Shutter is always set.
PRICE $18.00.

Send for Catalogue and copy of Modern Photography.

ROCHESTER OPTICAL COMPANY,
14 S. Water St., ROCHESTER, N. Y.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632.** Price 10 cents. To be had at this office and from all newsdealers.

PERFECT NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, Magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper. Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN.

WASHINGTON WHAT Uncle Sam and Aunt Columbia think, etc., of and SEATTLE. Send stamp to Eshelman, Llewellyn & Co., Seattle, W.

Mass. Institute of Technology,
BOSTON, MASS.

Courses in Civil, Mechanical, Mining, Electrical, Chemical, and Sanitary Engineering, and in Architecture, Chemistry, Physics, Biology, and Geology.
Entrance examinations in Boston, New York, Philadelphia, Washington, Pittsburg, Cincinnati, Chicago, St. Paul, St. Louis, San Francisco, Montreal, and Toronto. Catalogue free.

J. B. HENCK, Jr., Secretary.

GYMNASTICS FOR GIRLS.—AN INTERESTING account of the course of instruction given at the Berkeley Athletic Club for Ladies. With 18 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **753.** Price 10 cents. To be had at this office and from all newsdealers.

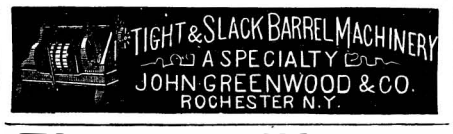
ROSE POLYTECHNIC INSTITUTE
Terre Haute, Indiana.—A School of Engineering
Well endowed, well equipped departments of Civil, Mechanical, and Electrical Engineering, Chemistry, Drawing. Shops and Laboratories. Expenses low. Address H. T. EDDY, President.

THE STEAM ENGINE; ITS PRINCIPLES, its development, its future and perfection.—A paper by E. N. Dickerson, giving an outline of the history of the steam engine, and discussing the principles upon which it operates and which limit its capacity. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **686.** Price 10 cents. To be had at this office and from all newsdealers.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc.
L. MANASSE, 88 Madison Street, Chicago, Ill.

ARTIFICIAL INCUBATION.—A DESCRIPTION of the French process of raising chickens. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **778.** Price 10 cents. To be had at this office and from all newsdealers.

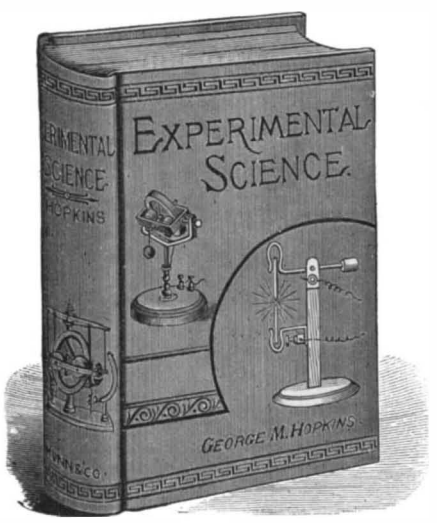


TYPEWRITERS.

Largest like establishment in the world. First-class Second-hand Instruments at half new prices. Unprejudiced advice given on all makes. Machines sold on monthly payments. Any Instrument manufactured shipped, privilege to examine. EXCHANGING A SPECIALTY. Wholesale prices to dealers. Illustrated Catalogues Free.
TYPEWRITER HEADQUARTERS, { 70 Broadway, New York. 144 La Salle St., Chicago.

The New Book.

Experimental Science



By GEO. M. HOPKINS.

740 Pages. Over 680 Illustrations.
PRICE, by mail, postpaid, $4.00

SEND FOR FULL ILLUSTRATED CIRCULAR AND TABLE OF CONTENTS.

This is a book full of interest and value for teachers, students, and others who desire to impart or obtain a practical knowledge of physics.

MUNN & CO., Publishers,
Office of The Scientific American
361 BROADWAY, NEW YORK.

What the Press says of "Experimental Science."

"Mr. Hopkins has rendered a valuable service to experimental physics."—*Evening Post.*

"The book is one of very practical character, and no one of a scientific turn of mind could fail to find in its pages a fund of valuable information."—*Electric Age.*

"The electrical chapters of the book are notably good, and the practical instruction given for building simple electrical machinery may be safely carried out by those—not a few—who like to make their own apparatus."—*Electrical World.*

"The author has avoided repeating the hackneyed illustrations which have been passed from one book to another so long, and, instead, offers a set of experiments which are largely of a novel character and very striking."—*Engineering and Mining Journal.*

"We commend it most heartily to all teachers."—*Normal Exponent.*

"It is a treat to read a book of this kind, that sets forth the principles of physics so fully, and without the use of mathematics."—*The Locomotive.*

"All teachers of science are aware that real knowledge is acquired best by the student making experiments for himself, and any one who points out how those experiments may be easily made is doing excellent work."—*English Mechanic and World of Science.*

"The work bears the stamp of a writer who writes nothing but with certainty of action and result, and of a teacher who imparts scientific information in an attractive and fascinating manner."—*American Engineer.*

"It should be found in every library."—*English Mechanic.*

"The book would be a most judicious holiday gift."—*Engineering and Mining Journal.*

"The portion of the book devoted to dynamic electricity covers over one hundred pages, and is extremely interesting and valuable."—*Brooklyn Standard Union.*

"Directions are given for demonstrating most of the laws of physics, with every-day tools and common appliances."—*American Photographer.*

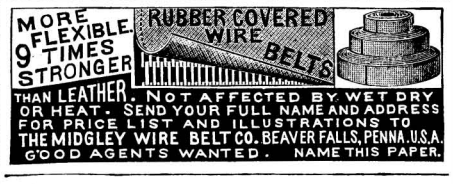
"Many of the experiments are new to print, while some of the old, familiar ones appear in modified form and with simplified apparatus."—*Public Opinion.*

PROPOSALS.

PROPOSALS FOR IMPROVEMENTS IN MAIL-BAGS, MAIL-CATCHERS AND MAIL-BAG LABEL HOLDERS.

POST OFFICE DEPARTMENT, WASHINGTON, D. C., February 28, 1891.—Sealed proposals from patentees or their assignees for granting the use of patented improvements in the mode of opening and closing mail-bags of any kind, and in the construction of mail-bags, mail-catchers, and devices for labelling mail-bags, will be received at this Department until noon, on Wednesday, the second day of September, 1891. All proposals must be in accordance with the specifications, which can be obtained from the Second Assistant Postmaster General, Mail Equipment Division.
JOHN WANAMAKER, *Postmaster General.*

U. S. Engineer Office, Custom House, Cincinnati, Ohio, April 28, 1891. Sealed proposals, in triplicate, will be received at this office until 12 M. (standard time) on Monday, June 1, 1891, for 1,000 barrels hydraulic Portland cement and 6,000 barrels American natural cement. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. For specifications and all information, apply to D. W. LOCKWOOD, *Major of Engineers.*


MORE FLEXIBLE. 9 TIMES STRONGER
RUBBER COVERED WIRE BELTS
THAN LEATHER. NOT AFFECTED BY WET DRY OR HEAT. SEND YOUR FULL NAME AND ADDRESS FOR PRICE LIST AND ILLUSTRATIONS TO THE MIDGLEY WIRE BELT CO. BEAVER FALLS, PENNA. U.S.A.
GOOD AGENTS WANTED. NAME THIS PAPER.

The Scientific American
PUBLICATIONS FOR 1891.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year - $3.00
The Scientific American Supplement (weekly), one year, - - - - - - - - - - 5.00
The Scientific American, Spanish Edition (monthly), one year, - - - - - - - - - 3.00
The Scientific American Architects and Builders Edition (monthly), one year, - - - - - 2.50

COMBINED RATES.

The Scientific American and Supplement, - - $7.00
The Scientific American and Architects and Builders Edition, - - - - - - - - - 5.00
The Scientific America , Supplement, and Architects and Builders Edition, - - - - - 9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti. O.

© 1891 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in next issue.

VICTORS MAKE THE PACE
HIGHEST GRADE
CATALOGUE FREE

OVERMAN WHEEL CO., CHICOPEE FALLS, MASS.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.
A. G. SPALDING & BROS., SPECIAL AGENTS.
CHICAGO. NEW YORK. PHILADELPHIA.

ELECTRIC POWER TRANSMISSION in Mining Operations.—By H. C. Spaulding. A brief presentation of some of the work already done toward the application of electrical apparatus to mining processes, with some practical suggestions and statements from those who have had personal experience in the operations of such apparatus. With 2 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **783.** Price 10 cents. To be had at this office and from all newsdealers.

SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO.
WATER TUBE
STEAM BOILERS
30 CORTLANDT ST. N.Y.
107 HOPE ST. GLASGOW, SCOTLAND.
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

Awarded the Grand Prize at late Paris Exposition.

Scientific Book Catalogue

RECENTLY PUBLISHED.

Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.

MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

STENCILS, STEEL NAME STAMPS, STEEL

Figures, Alphabets, Burning Brands, and Log Hammers, Printing Dies, Brass Signs, Door Plates and Seals.
BELLOWS & KONIGSLOW,
314 Seneca St., Cleveland, O.

DEVELOPMENT OF AMERICAN Blast Furnaces, with special reference to large Yields.—By James Gayley. A description of some of the principal blast furnaces in the United States, showing the changes in design and practice by means of which extraordinarily large yields have been obtained in the last decade. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **776.** Price 10 cents. To be had at this office and from all newsdealers.

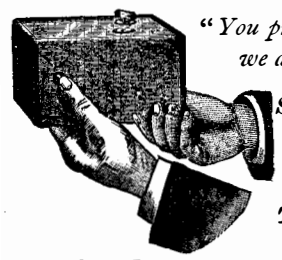
¾ to 50 H. P. THE **Motor of 19th Century**

Can be used *Any Place*, to do *Any Work*, and by *Any One*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address

Economy, Reliability, Simplicity, Safety.
CHARTER GAS ENGINE CO.
P. O. Box 148, Sterling, Ill.

WANTED, A second-hand single color Printing Machine capable of doing forty-inch goods, also a grounding and padding machine for the same goods. Please state price, full particulars, and where it can be seen.
J. N., 124 Clinton Place, New York City.

NEW KODAKS

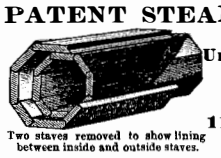


"You press the button, we do the rest."
Seven New Styles and Sizes
ALL LOADED WITH
Transparent Films.

For sale by all Photo. Stock Dealers.
THE EASTMAN COMPANY,
Send for Catalogue. ROCHESTER, N. Y.

SMALL ELECTRIC MOTOR FOR AMateurs.—By C. D. Parkhurst. Description in detail of a small and easily made motor powerful enough to drive a ten or twelve inch brass fan and to give a good breeze. With 15 figures drawn to a scale. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **767.** Price 10 cents. To be had at this office and from all newsdealers.

PATENT STEAM-PIPE CASING
—FOR—
Underground Steam Pipes



Two staves removed to show lining between inside and outside staves.

A. WYCKOFF & SON,
116 East Chemung Place,
ELMIRA, N. Y.

JAMES LEFFEL WATER WHEELS
ENGINES, and BOILERS.
JAMES LEFFEL & CO.
FARLO ST., SPRINGFIELD, OHIO.
110a Liberty Street New York City.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
FINE TINNING, JAPANNING AND FINISHING.
THOMAS DEVLIN & CO.
LEHIGH AVE. & AMERICAN ST. PHILA.

$85 Lovell Diamond Safety $85

Diamond Frame, Steel Drop Forgings, Steel Tubing, Adjustable Ball Bearings to all Running Parts, including Pedals. Suspension Saddle. Finest material money can buy. Finished in enamel and nickel.

Strictly high grade in every particular. No better machine made at any price.

Bicycle Catalogue Free. Send six cents in stamps for our 100-page illustrated catalogue of Guns, Rifles, Revolvers, Sporting Goods of all kinds, etc.

JOHN P. LOVELL ARMS CO., 147 Washington Street, BOSTON, MASS.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page, or address MUNN & CO., Publishers,
361 Broadway, New York.

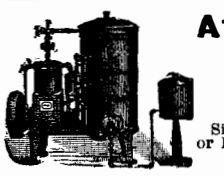
ARMSTRONG MAN'F'G. CO.

Our ADJUSTABLE STOCKS and DIES are universally acknowledged to be the
BEST!
We also make all our Tools on the same principle, of the BEST MATERIAL and WORKMANSHIP, and always with a view of time and labor saving in their use.
BRIDGEPORT, CONN.

SEWING MACHINE MOTOR FOR AMateurs.—By C. D. Parkhurst. Description of a very simple and effective motor, with laminated armature, of sufficient power to actuate a sewing machine. With 11 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **759.** Price 10 cents. To be had at this office and from all newsdealers.

MACHINE TOOLS
Engine Lathes, Planers, Shapers, Turret Lathes, etc. *Send for Catalogue.*
The Hendey Machine Co., Torrington, Conn.

THE PENNA. DIAMOND DRILL & MFG. CO.
BIRDSBORO, PA., Builders of High Class Steam Engines. Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.



After being on the Market Five Years
The "ACME" Still Leads!
Sizes One, Two, Three, and Four Horse Power. Arranged for either NATURAL GAS or Kerosene Oil fire, as ordered. No extra insurance required on account of the oil fire.
Send for catalogue giving full particulars and prices.
Acme Automatic Safety Engine.—"Stationary." Oil Tank. ROCHESTER MACHINE TOOL WORKS, Brown's Race, ROCHESTER, N. Y.

GRAPHOPHONE AND PHONOGRAPH.—An interesting account of the Edison, Bell, and Tainter apparatus for the mechanical reproduction of speech, with detailed description of the same. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **669.** Price 10 cents. To be had at this office and from all newsdealers.

H.W. JOHNS' ASBESTOS STEAM PACKING
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE.
H. W. JOHNS MFG. CO., 87 Maiden Lane, N.Y.

WORKING MODELS and Experimental Machinery, metal or wood, made to order by MASON & RAUCH, successors to J. F. Werner, 47 & 49 Centre Street, New York.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

• The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

ELECTRIC PERCUSSION DRILLS
Marvin System of Percussion Tools.

Drill contains no commutator nor moving contacts.
All circuits are protected in closed metallic cases.
More economical, simpler, and more easily handled than steam or air drills.
Safe and reliable. Not affected by moisture, dampness, or dripping water.
Weight of drill, with tripod, about 400 pounds.
Speed of drilling in hard granite, 2 in. hole, 2 inches per minute.
Send for descriptive pamphlet and prices.
Edison General Electric Co.
Edison Building, Broad St., New York.

DRY AIR REFRIGERATING MACHINE. Description of Hall's improved horizontal dry air refrigerator, designed to deliver about 10,000 cubic feet of cold air per hour, when running at a speed of 100 revolutions per minute, and capable of reducing the temperature of 90° above to 50° below zero. With five figures, showing plan and side elevation of the apparatus, and diagrams illustrative of its performance. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **288.** Price 10 cents. To be had at this office and from all newsdealers.

CHEMIST JAMES F. BABCOCK, 27 School Street, Boston.
Analyses of all kinds. Ores, Toilet and Food Preparations, etc. Advice to Mfrs. Correspondence solicited.

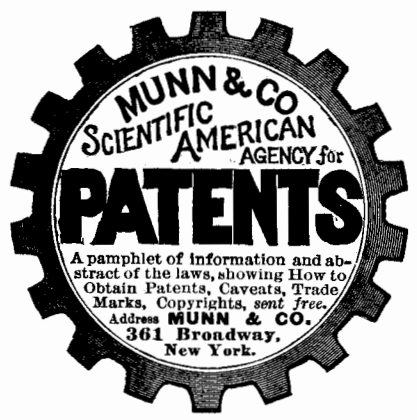
THE WONDERFUL MAGIC POCKET SAVINGS BANK

LOCKS and REGISTERS DEPOSITS! Opens itself when $5 in dimes have been deposited. Fits Vest Pocket! Postpaid to any address on receipt of **25c.** Money refunded if not satisfactory. Agents wanted. Write for circulars of Magic Novelties. Mention this paper.
Magic Introduction Co., 227 Bway. N. Y.

Unscrupulous parties are offering cheap worthless imitations of the Magic. Beware of them. Get a Magic Bank and compare it with the imitations.

STEAM ENGINE, HOW TO MANAGE. By J. C. S.—A very practical paper on the subject. How to fire with wood and coal, how to manage the water supply, how to clean the engine, how to clean the supply pipe, how to gauge the pump, etc. With 12 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **747.** Price 10 cents. To be had at this office and from all newsdealers.

CUSHMAN CHUCKS
Complete line for all uses shown in new illustrated catalogue, *free to all.*
Cushman Chuck Co., Hartford, Conn.


MUNN & CO
SCIENTIFIC AMERICAN AGENCY for
PATENTS
A pamphlet of information and abstract of the laws, showing How to Obtain Patents, Caveats, Trade Marks, Copyrights, *sent free.*
Address MUNN & CO.
361 Broadway, New York.

ALUMINUM. AN INTERESTING DEscription of the various methods of manufacturing this metal, chemical and electrolytic; with special reference to the Heroult method. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **753.** Price 10 cents. To be had at this office and from all newsdealers.

MOSS ENGRAVING COMPANY 535 PEARL ST. COR. ELM NEW YORK
OUR PROCESSES: MOSS-TYPE, PHOTO ENGRAVING, ZINC ETCHING
WE DO FINE PRESS WORK
Engravings direct from photographs and other copy. Our circular "N" shows specimens. Fine printing a specialty.

THE GRAVES ELEVATORS.
PASSENGER & FREIGHT L. S. GRAVES & SON ROCHESTER, N.Y.
NEW YORK. BOSTON. ST. LOUIS. DETROIT.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

If you want the SIMPLEST and BEST
GATE VALVE

for low pressures (below 60 lbs.) whether for Steam, Gas, Water, Oils, or Thick Fluids, investigate the "Handy." It is more compact and costs much less than any other Gate Valve. Write for Catalogue.
The Lunkenheimer Brass Mfg. Co.
15-17 E. 5th St., Cincinnati, O.

NEW MAIL

New Grade, $100.
CUSHION TIRES and TANGENT SPOKES.
Handsomest and Best Diamond Safety.
Send for Catalogue and Second-Hand List.

Also Sole New England Agents for
LITTLE GIANT

PRICE, $35.00.
Only Boy's Safety with a Spring Fork, preventing injury to young riders from jar and vibration.
WM. READ & SONS, 107 Washington St. BOSTON, MASS.

THE Scientific American

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage. Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

THE Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St. opp. Duane, New York

© 1891 SCIENTIFIC AMERICAN, INC.